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Mortara INSTRUMENT

ELI 100 Service Manual

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7865 N. 86th Street
Milwaukee, Wisconsin 53224

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1 General

Service Manual Purpose

The purpose of this manual is to supply information to service personnel so they can maintain the ELI 100 12-Lead Electrocardiograph at the assembly and subassembly level. Although the manual includes parts lists, mechanical assembly parts, and printed circuit board information, it is intended to function primarily as a guide to preventative and corrective maintenance and electrical repairs considered field repairable.

User Safety Information

Periodic Safety Inspections

Follow the recommended maintenance schedule. Inspect the power cord and transmission cables periodically for fraying or other damage and replace as needed. Broken or frayed wires may cause interference or loss of signal. Pay particular attention to points where wires enter connectors.

Proper Power Cord

Use only the power cord specified for the equipment. This product requires a three-wire, (18 gauge, SJT-grade) power cord, which is supplied with a three-terminal, polarized plug (hospital grade) for connection to the power source and protective ground. Use only a power outlet with a protective ground outlet. An interruption of the grounding connection could cause an electrical shock hazard.

Proper Fuse

Use only the fuse specified for the equipment (identical in type, voltage and current rating). Substituting a different fuse type could cause a fire hazard. Always make sure fuses have been installed before operating the unit.

Do Not Operate in Explosive Atmospheres

Do not operate the ELI 100 in the presence of flammable gasses or anesthetics; this environment could cause an explosion. Refer to Operator's Manual Safety Information: Warning(s) and Caution(s).

Use Only Safe Methods of Interconnection

To prevent electrical shock from the product when it is connected to other electrical equipment, proper grounding is essential. Refer to Operator's Manual Safety Information: Warning(s) Peripheral equipment.

Do Not Mount Product above Patient

Do not mount or place the product where it could fall on a patient or where it could be accidentally knocked off a shelf or other mounting arrangement.

Recommended Accessories

For the patient's safety and optimum equipment performance, use only the accessories specified by Mortara Instrument, Inc.

Sterilizing this Product

Do not sterilize this product or any accessories unless specifically directed by the manufacturer. Sterilization and sterilization environments can seriously damage many components and accessories.

Liquid Spills

Do not set beverages or other liquids on or near the ELI 100, and/or optional equipment.

System Information Log

See Appendix "A" of Operator's Manual

Product Information

See Section 1 of Operator's Manual

Equipment Symbols

Symbol Delineation

Electrostatic sensitive devices

2 Maintenance and Cleaning

CAUTION:

Remove battery fuse at right rear of unit before attempting any disassembly. Also, removing the fuse at the right rear of the unit will cause the configuration parameters to reset to the default setting. In addition, all ECGs stored in memory will be lost.

Introduction

This section provides servicing and maintenance instructions for the ELI 100 interpretive electrocardiograph. Subsequent parts of this section are disassembly, inspection techniques, cleaning techniques, and installation.

Recommended Cleaning Supplies

- Anti-static mat & wrist band, properly grounded
- Clean, lint-free cloth
- Cleaning solvent (isopropyl alcohol, 99% pure)
- DRY, low pressure, compressed air (30 psi)
- Electronic safe non-residue solvent, such as Flux-off
- Masking tape
- Non-metallic, soft-bristle brush
- Naphtha
- Vacuum cleaner, Static Safe

List of Repair Materials

- Screwdriver Philips #2.
- Screwdriver, flatblade.
- Nutdriver set, standard.
- Multimeter.
- Oscilloscope.

Note: The equipment and solvent mentioned above are standard shop commodities that are available from commercial sources. If in the performance of normal maintenance or repair, the PCB assembly, AC connector assembly, AC switch assembly, or writer assembly are removed or replaced, a leakage test should be performed. See section on testing.

Cleaning and Inspecting Techniques:

This section contains instructions for periodic cleaning and inspection of the instrument as preventative maintenance measures. It also contains specific cleaning procedures to be conducted after disassembly. Parts having identical cleaning procedures are grouped under common headings. No special tools are required.

Interior Cleaning:

WARNING

Ventilate work area thoroughly when using solvents. Observe manufacturers warnings on solvent containers with regard to personnel safety and emergency first aid. Be sure that first aid equipment is available before using chemicals. Observe shop safety and fire precautions. Ventilate all work areas where solvents are used. Store solvents and solvent-soaked rags in approved containers. Refer to manufacturers' instructions on containers for recommended fire-fighting procedures, and make sure that fire-fighting equipment is available.

Magnetic Cleaning:

CAUTION

Do not use solvents to clean transformers or inductors. The chemical action of solvents may remove the varnish from the wire coils, rendering the components useless. The solvent also neutralizes the adhesive of the cover tape, resulting in eventual tape separation from the windings.

Clean transformers and inductors with a dry, non-metallic, soft bristle brush.

Printed Circuit Board Cleaning.

Clean assembled parts with a vacuum cleaner or low pressure compressed air (60 psi). Take care when cleaning printed circuit boards that wires or component leads are not bent back and forth in such a manner as to weaken them and cause them to eventually break.

Prior to soldering, clean surfaces with a nonmetallic, soft bristle brush dipped in solvent.

Dry with low pressure compressed air.

Metallic and Plastic Parts Cleaning

CAUTION

Do not wipe over surfaces of nameplates or labels with abrasive cleaners or materials, as this will eventually wear away the nameplate information. Do not use solvents to clean plastic parts.

Brush all surfaces and parts with a nonmetallic, soft bristle brush.

Wipe metal surfaces with soft, nonabrasive cloth dampened with isopropyl.

Dry surfaces with clean cloth.

Wipe surfaces of nameplates and labels with dry cloth.

Exterior Cleaning.

Use a damp cloth to clean external covers and the line cord. Do not use alcohol, solvents, or cleaning solutions. These cleaning agents may damage the surfaces of the instrument.

Printhead Cleaning

Open the writer cover as explained in the section on final assembly.

Apply isopropyl alcohol to a clean cloth, and wipe the writer printhead until all foreign matter is removed.

After cleaning is completed, inspect the unit using the techniques described previously.

After the inspection is complete, install the cover as explained in the section on final assembly.

Inspection of Writer Assembly Harness

Visually inspect the wire harness for wear, maintenance damage, corrosion, deterioration, and damage resulting from dropping.

If no defects are found, install the cover and restore the unit to service.

If a defect is found in the cable, replace it with a new cable.

Note: ***The removal of the writer assembly as explained later in this section, may be necessary to replace the cable. After a cable is replaced, re-install the cover.***

Printhead Adjustment

Refer to section on Testing and Troubleshooting.

Exterior Inspection

Visually inspect the entire instrument for wear, maintenance damage, corrosion, deterioration, and damage resulting from dropping.

Interior Visual Inspection

Check components, wiring, solder joints and printed circuit conductor patterns.

Check all connectors for loose, bent or corroded contact points

Check wire, harnesses and cables for signs of wear or deterioration.

Inspect sleeve and tubing for proper installation or evidence of damage.

Inspect components and their leads for security of mounting, deterioration or leakage.

Check terminals and connections for proper installation, failed soldering, loss or wear.

Inspect PCB surfaces for charring, cracking or brittle's.

Note: Some degree of discoloration of the PCB surface may be expected due to continued exposure to the operating temperatures of some of the components.

Check the identification nameplate and other decals for legibility.

Inspect chassis, covers, and brackets for warping, bending, surface damage or missing captive hardware.

Check all screws and nuts for tightness or signs of stripped or crossed threads.

Check for damage traces on PCBs. Look for lifted conductors and inspect for breaks, scratches, nicks, or pin holes.

Check for any other form of mechanical damage in which may indicate a failure.

If, during the process of normal maintenance or repair, the PCB assembly, AC connector assembly, AC switch assembly, or writer assembly are removed and replaced, perform the leakage test as describe in the section on Testing and Troubleshooting.

Preventative Maintenance Schedule:

Maintenance to be Performed	Period	Notes
Clean and inspect unit.	6 mo.	Perform every 3 mo. if unit is in heavy use.
Printhead cleaning	80 hrs	Perform every 40 hrs, if unit is being used with ELI-XR.
Check printhead wire harness.	160 hrs	-
Printhead adjustment	-	Adjust printhead when print head is replaced.
Leakage tests.	-	-

Table 1

Cover Assembly Removal / Installation

Open the writer cover and remove the six flathead screws securing it. They are located at the front and on both sides of the unit, near the bottom.

Lift the cover assembly gently and tilt it towards the right side of the unit as seen from the front. Set the cover assembly on its right side.

Unplug the paper drive motor cable (J6 of PCB), the power/data cable (J9 of PCB), the two keyboard cables (J4 of PCB), and the LCD cable (J1 of PCB). Remove the writer mounting screw that holds the ground wire.

Note: Orientation for the J4 keyboard plug is as follows:
P12 is marked with 1 on one half of the flex tape. This half of P12 goes to J4 pin 9 of PCB.
The other half of the flex tape is marked with 9. This half plugs into J4 pin of the PCB.
J4 pin 9 is adjacent to pin 1.

Set the cover assembly aside with the top facing up. Reassemble on reverse order.

Writer Removal / Installation:

Remove the four Philips screws, which attach the cover assembly to the base of the unit. They are located at the front and at both sides of the unit, near the bottom.

Unplug the printhead cable.

Remove the remaining writer mounting screws on the under side of the cover assembly.

Lift the writer from the tray and pull the paper drive motor cable through the slot at the rear of the tray. It may be necessary to do some maneuvering with the connector. Reassemble in reverse order and see note under Printhead Removal below.

Printhead Removal / Installation:

Remove the four printhead-mounting screws. If a tool is available for removing the E-rings, remove them from both ends of the metal support bar and remove the bar in order to facilitate printhead removal.

Slide the printhead forward and gently press down on the printhead connector until it clears the lid assembly.

Remove the printhead. Reassemble in reverse order.

CAUTION

When installing a new printhead, make sure that the front edge of the printhead lines up flush with the front of the lid before tightening the mounting screws. After the unit is reassembled, run the writer self test as described under performance testing in the section on Testing and Troubleshooting. It may be necessary to loosen the screws and skew the printhead slightly at the top or bottom in order to get even printing across the entire trace.

Paper Drive Motor Removal / Installation:

The writer must be removed from the unit first. Then, remove the screws, which hold the paper tray to the writer chassis. Lift the paper tray part way.

Using a 1.3 mm Allen wrench, loosen the set screw on the motor gear and slide the gear off the shaft.

Remove the two mounting screws, which hold the motor to the chassis.

Remove the motor. Reassemble in reverse order.

Note: There are two different sets of threaded holes for the mounting screws. One is metric and one is English. Try the mounting screws on the motor first before attempting to install the motor.

Printed Circuit Board Assembly Removal / Installation:

Disconnect all cables connecting the cover assembly (J1, J4, J6, and J9) to the circuit board and set the cover aside.

Unplug the battery cables from J10. Remove the two screws, which hold the battery tray to the base of the unit and remove the battery pack.

Unplug the AC input assembly, (J8).

Remove the screw, which mounts the processor module to the base, and carefully remove the processor module from its mating connection (J5). Remove the seven screws, which mount the board. Reassemble in the reverse order.

CAUTION

When installing a new board, remove the battery fuse from F1 first. When all cables and the batteries have been connected to the board, install the fuse.

Keyboard Removal / Installation:

Remove the cover, as explained previously.

Unplug the keyboard from J4 of the circuit. Note the position of the connectors.

Check the underside of the cover for four or five keyboard mounting nuts.

Use a 5.5mm nut driver to remove the nuts from the threaded studs in the keyboard.

Remove the two connectors through the slot in the cover assembly.

Removed any large deposits of glue from the cover assembly. If needed.

CAUTION

Before reassembling in reverse order contact the manufacture to insure the proper keyboard replacement part number.

Orientation for the J4 keyboard plug is as follows:
P12 is marked with a 1 on one half of the flex tape. This half of P12 goes to J4 pin 9. The other half of the flex tape is marked with a 9. This half plugs into J4 pin 1 of the PCB. J4 pin 9 is adjacent to pin 1.

LCD Removal / Installation:

Remove the cover from the unit as explained previously.

Unplug the LCD ribbon cable from the LCD assembly.

Remove the four screws, which mount the LCD assembly to the inside of the cover.

Remove the LCD assembly. Reassemble in reverse order.

CAUTION

The connector on cable for the LCD lead has one smooth side and one side with the key tab. When the connector is installed, the key tab side of the connector is toward the cover. The smooth side is toward the PC board.

When installing a new LCD assembly, inspect it first for scratches, smudges, lint, or dust. Clean with a soft cloth.

Batteries Removal / Installation:

Remove the cover as explained previously.

WARNING

Removing the batteries or the fuse will cause a complete loss of stored memory.

Make sure that the battery fuse has been removed from F1 of the circuit board.

Disconnect the battery leads by removing connector J10 from the circuit board.

Removed the two screws, which attach the bracket to the tray of the battery pack. Remove the bracket and the batteries.

Disconnect the Battery Interconnect Leads. Remove the Batteries.

CAUTION

Be sure that the polarity of the batteries is correct, In addition, the batteries should be in series for a total voltage of 18V or more.
Use only Mortara replacement batteries, Mortara part #4800-003, 6V, DC, 1-Amp, Gel cell.

Reassemble in reverse order.

3 Technical Description

Introduction

The MORTARA ELI 100 is an advanced interpretive electrocardiograph system utilizing the latest electronic technology and software. The ELI 100 offers 12 lead patient ECG monitoring, a 2 line by 40 character LCD display, a full function touchpad keyboard, a 4-inch thermal writer for printing waveforms and interpretive data, a real-time electronic clock and calendar, an RS-232 level serial communications port, internal MODEM, a high-speed logic-level serial communications port, and internal power supply, batteries, and battery re-charge circuitry. The system utilizes CMOS digital components to minimize power consumption and enhance performance. The ELI 100 is a modular assembly taking advantage of standard sub-assemblies designed at Mortara Instrument, Inc.

The system consists of the following major sub-assemblies and parts:

- Mortara Processor Module (MPM)
- Mortara MODEM Module (MMM) - optional.
- Main System board (Motherboard) Assembly
- Keyboard
- LCD Display
- Writer Assembly
- Batteries
- AC Input Power Selector and AC Power Switch Assemblies
- Various other Interconnect Cable Assemblies

The basic operation of each of the above will be covered in the following sections.

Processor Module (MPM)

The MPM is a propriety plug-in module forming the processing core of the ELI 100. This module, based on the Motorola MC68332 micro-controller, controls all aspects of ELI 100 operation. The basic system bus architecture and timing is derived from the 68332 local bus interface. This module is always installed in the ELI 100.

The module contains RAM memory for processing and storage of ECGs, non-volatile memory for storage of the micro-controller program and special configuration parameters, and a real-time clock chip for tracking time-of-day and date. The module also contains Mortara propriety integrated circuits (ICs) which receive and pre-process ECG data from the Front-End module. The Serial Communications Interface (SCI), a Universal Asynchronous Receiver-Transmitter (UART) serial interface, is supported by the MPM and is used throughout the ELI 100 for serial communications as described in later sections. The signal lines for this interface are named TXD and RXD.

Modem Module (MMM)

The MMM is a propriety plug-in module which adds MODEM capabilities to the ELI 100. Currently, this module is optional and may not be installed in all units.

The MMM is a 2400 baud MODEM conforming to v.21/v.22/v.22 bis and Bell 103/212A standards. Serial data transmission and reception is accomplished via the MPM SCI (UART) interface. The MM accepts an input (CH0) from the MPM for ON HOOK/OFF HOOK control. The MMM provides a RING INDICATE output signal (CH1) for detection by the MPM.

Main System Board

The main system board contains all the interfaces and support circuits required in the ELI 100 including system bus support, RS-232 and high-speed serial communication ports, writer, keyboard, and LCD display interfaces, patient cable connection and Front-End Module for ECG acquisition, power management circuit, and power supply.

RS-232 Level Serial Port/High Speed Serial Port

The ELI 100 has one 9 pin sub-miniature "D" female connector on the back of the unit. Both RS-232 serial communication and high-speed serial communication are available via this port. The RS-232 communication data rate is programmable up to 38,400 bps or 57,600 bps when the ELI 100 is configured as a ST Monitor. Note connector J11 on the ELI 100 schematics for the pin numbers used for RS-232 communication.

U21 and associated circuitry perform the required level shift conversion between logic voltage levels and RS-232 compatible levels. The tri-state buffers (U8) which are controlled directly by the MPM determine the source/destination of the serial data to this port.

High-speed data communication is also available at J11 (pins 1 and 9). This is a logic level serial port with communication performed at 1.25Mbit/sec. The tri-state buffers (U8) controlled by the MPM are used to connect the ISOLINK (U17) high-speed output to the external high-speed port.

Writer Interface

The writer interface consists of all support circuits required to run the writer. These include the motor control circuit, printhead signal interface and printhead power interface.

Writer Motor Control

Q7, Q8 and associated circuits comprise the motor drive circuit. Motor speed is adjusted via the signal CH10, which is a 10 KHz, variable duty-cycle, pulse-width modulated output of the MPM. In controlling the motor speed, the higher the applied duty cycle, the faster the motor will turn. Signal CH9 serves as the brake FET (Q6) control and printhead signal enable, while the inversion of this signal, CH9n, is an enable signal to the motor drive circuit. The writer motor is connected to the J6 connector on the main system board.

Closed loop control of the motor speed is accomplished in software, using feedback from the motor's shaft encoder, which is filtered by R88, C60 and received by U12. The motor encoder pulses cause this circuit to generate interrupts (on IRQ6n) to the MPM. The interval between interrupts is a direct measure of the motor speed, hence the writer paper speed. The MPM must reset this circuit by pulsing signal R34n after each interrupt.

Printhead Signal and Power Interface

The printhead signal interface is accomplished through the Mortara propriety Thermal Printhead gate array (TPH_GA), U2. Static RAM chip U1 is used by the TPH_GA in performing dot hysteresis control. U20 simply buffers signals to the printhead, while RP5 forms a filter with the cable capacitance to help reduce EMI emissions. The printhead cable (30 conductor, ribbon cable) plugs into connector J9 on the main system board. All power and control signals required for controls of the printhead are carried through this cable.

The strobe-width adjust circuit (U18, D16, D17, D20, D21 and associated circuits) is designed to adjust the length of the print strobe based on changing conditions of printhead voltage and temperature. Strobe time will lengthen as the printhead voltage, VHEAD, decreases. Strobe time will also lengthen as printhead temperature, as gauged by a thermistor on the printhead, decreases. The circuit attempts to match the "delivered energy per pulse" curve as specified by the printhead manufacturer. This helps to ensure consistent quality printouts over a wide range of operating conditions.

Power to the printhead "heater elements", the heat from which actually makes images appear on the paper, is supplied to the writer via J9 (pins 2, 4, 6, 8, and 10). The system power supply provides power to the printhead either directly from the batteries or from the AC supply (if AC power is connected), or under heavy printing load, both sources. Capacitor C71 stores energy for the fast, heavy current surges required by the printhead.

VHEAD is a switched output (via Q16, Q17) which allows the voltage to be turned off by the MPM when the printhead is not in use. The VHEAD current is limited to approximately 1.5 amps via R103 and Q5. Note that D22, C64, and R102 are only provisional components and are not presently installed.

Keyboard Interface

Electrically, the keyboard is arranged as an 8 x 8 matrix, which is polled on a periodic basis to determine which key(s) are being pushed. The keyboard cable plugs into connector J4 on the main system board.

The keyboard interface (U4, U6, RP2, RP4, and D1) allows the MPM to poll the keyboard for keypushes. Polling is performed by MPM writes to the row driver latch (U4) which drive "ROW" signals (ROW1 - ROW8) to a "low" state one at a time. The code read subsequently from the "COLUMN" signals via U6 (COL1 - COL8), along with the knowledge of which ROW signal was driven low, indicates which key(s) in the matrix are being pushed.

The COL8 is also input to the power management circuit which allows the unit to be powered on via the keyboard ON/OFF key when operating from batteries alone.

The keyboard itself is mounted on the top cover with the interconnect cable extending through a slot to the inside of the cover. The cable must be plugged into the J4 connector on the main system board as the top cover is being placed on the unit.

The keyboard grounding plate is installed on the inside of the top cover at both the right and left sides of the keyboard. With the cover installed on the unit, the plate contacts both the keyboard backplate and the chassis to provide an affective path for conducting Electrostatic Discharge (ESD) pulses away from sensitive circuitry.

LCD Interface

The electrical interface to the LCD display is accomplished through the J1 connector on the main system board. Interface signals CH6, CH5 (from the MPM) and CS_LCD (from the ISOLINK, U7) are the LCD Register Select, Read/Write, and Enable signal, respectively. Series resistors R2 and RP1 form a filter with the cable capacitance to help reduce EMI emissions. Resistors R4 and R6 set the contrast control voltage to the LCD display.

The 2 x 40 character LCD display is mounted on the inside of the top cover with the cable extending to the left as the cover is viewed from the operator's normal viewing position. The active area of the LCD display is visible through the protective plastic window directly above the keyboard. The LCD display cable must be plugged into the J1 connector on the main system board as the top cover is being placed on the unit.

Patient Input

The patient cable is connected to the J2 connector on the left side of the unit. This is a 15 pin subminiature "D" (female) connector. Patient signals are input to a propriety Front-End module (FE1) mounted on the main system board. The Front-End module samples the input signals and digitized data is transmitted via synchronous serial data stream to the MPM for processing, storage and printing.

Spark gap SG1 and resistor R24 allow a path for ESD currents applied to the patient inputs. R25 provides a very low current discharge path to prevent build-up of excess charge on the cable shield.

Speaker Interface

The speaker (SP1) is a piezo element mounted on the main system board and driven by Q14, R35 and R30. The CH15 signal from the MPM provides the waveform, under software control, to drive the speaker. Key click "volume" setting is accomplished by altering the frequency, duty-cycle and/or duration of pulses to the speaker.

Power Management Circuit

The power management circuit (U12, U13, U16, and associated components) control power flow in the ELI 100. This circuit provides the following functions:

- Keyboard power-on support.
- 5V (VCC) Logic supply power ON / OFF control.
- Hardware watchdog.

The keyboard power-on circuit senses the depression of the keyboard ON / OFF key and turns the 5V logic supply ON. This circuit is powered from 5V (back-up power), which is available any time the batteries and fuse are installed.

The 5V logic supply is automatically latched ON anytime AC power is applied. Furthermore, when AC power is applied the logic supply can not be turned off.

The signal W24n, controlled by the MPM, is pulsed low to turn off logic supply. Pulses on this line will turn the logic supply off only when AC power is OFF.

The hardware watchdog circuit is intended as a fail-safe to prevent deep discharge of the batteries and loss of ECG data in the unlikely event of a processor error or other system reset. During normal operation, signal WDOGn is pulsed by the MPM on a periodic basis, which continually resets the watchdog circuit. If WDOGn pulses cease for a period of approximately 2 seconds, the watchdog circuits will time out and attempts to turn off the logic supply.

Power Supply

AC Input Power

AC power connected to the ELI 100 at the back of the unit using a suitable line cord. The voltage selector tumbler setting and fuse ratings must match the voltage applied to the unit.

The AC power switch, located on the back of the unit must be in ON position to power the unit from the AC source and to change batteries.

The AC power wiring connects to a mating connector on the main board (J8) which routes the AC input to the primary side of the power transformer.

The transformer secondary side connects the AC power to the power supply circuits on the system board.

AC power is rectified via bridge B1 and filtered by C34. This is the raw DC supply used by the charger supplies. R13, R14, R15, C18, and Q1 form an AC power detection circuit. The signal ACONn goes low to turn on the logic supply when AC power is applied. This signal can also be read by the MPM.

Battery Connections

The three, 6V lead-acid gel-cell batteries are connected in series to form a nominal 18V-battery supply. The positive lead from the batteries runs through the fuse at the back of the unit, and back to the connector on the cable harness with the battery negative lead. Battery connection to the system board is made at the J10 connector.

This unit is capable of full operation from batteries.

Battery Charger and Printhead Supply

The battery charger and printhead supply (U14 and associated circuits), are controlled by the UC3906 battery charger controller IC (U11 and associated circuits). This temperature compensated controller monitors charging current and adjusts output voltage accordingly to control the charging profile of the batteries. Nominal "float charge" voltage is approximately 20.55V, while high-end "bulk charge" voltage is approximately 22.2V.

The same voltage applied to the batteries is also used to power the printhead heater elements during printing operations (as described above).

U18, R77, R78, C49, R56 and D12 form the battery charging detector circuit. The signal CHARGEn will be "low" when the batteries are being "bulk charged". When the charge controller switches to "float" mode, CHARGEn will go high. This information is available to the MPM for status message purposes.

5V Logic Supply

The 5V logic supply (U10 and associated circuits) powers all the logic devices in the unit. This supply is controlled by the power management circuit through FET switch combination Q2 and Q4.

5V Back-up Supply

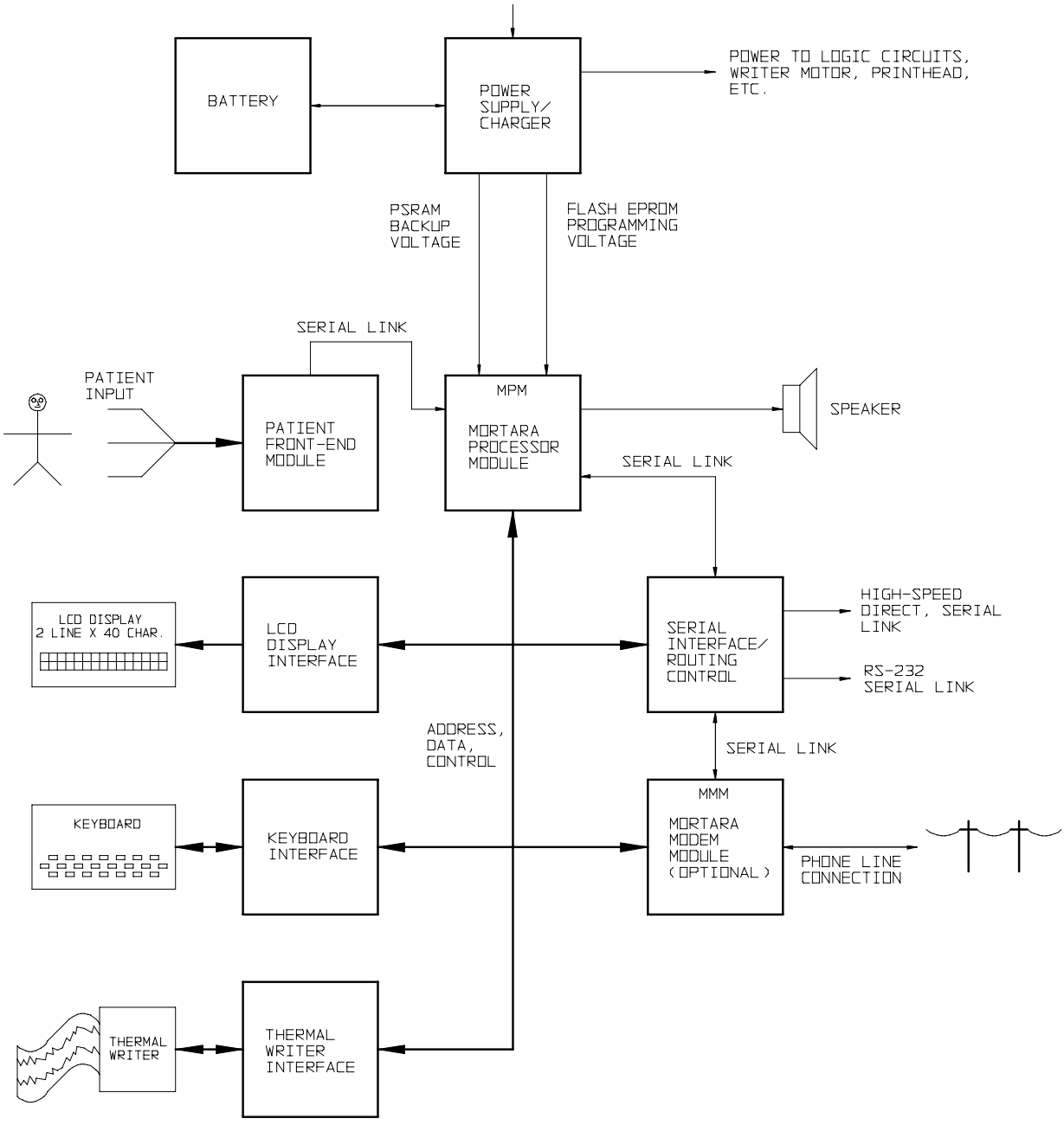
The 5V back-up supply (U9 and associated components) supplies power to devices which, must operate or save memory when the 5V logic supply is off. The output voltage of this supply is a actually approximately 4.6 volts.

U9 also provides battery voltage monitoring support. Battery voltage is sensed through divider circuit R26, R42, R31 and D9. The voltage is compared to a reference voltage inside U9 and U9 outputs the LOBATTn signal, which can be read by the processor. Signal CH3 from the MPM serves to shift the compared voltage to facilitate detection of two battery voltage levels. The higher voltage threshold is termed "battery depleted". When the MPM detects "battery depleted", the software will power off the unit.

12V Programming Supply

This supply (U17 and associated circuits) provides power used in programming FLASH memory devices on the MPM card. This supply must be enabled by the MPM (signal 12VONn).
For some older equipment it may be necessary that MPM (signal 12VONn) enable the supply, but also requires that the unit be "tilted" approximately 30 degrees from level. Mercury switch SW1 is included to prevent unintentional programming operations. Th 12V supply will remain disabled unless the unit is tilted.

Block Diagram
A/C Power



Keyboard Matrix

COLUMN

ROW	1	2	3	4	5	6	7	8
1	SPF	Z	X	C	V	B	N	
2	SLT	0	3	4	7	8		
3		1	2	5	6	9		
4		E	R	U	I		ECG	
5	SHIFT	Q	W	T	Y	O	RHY	
6	ENT	D	F	J	K	P	XMT	
7	STOP	A	S	G	H	L	M	
8								DC ON OFF

Battery Charging

The ELI 100 operates on AC power or on an internal battery which can be charged by doing the following:

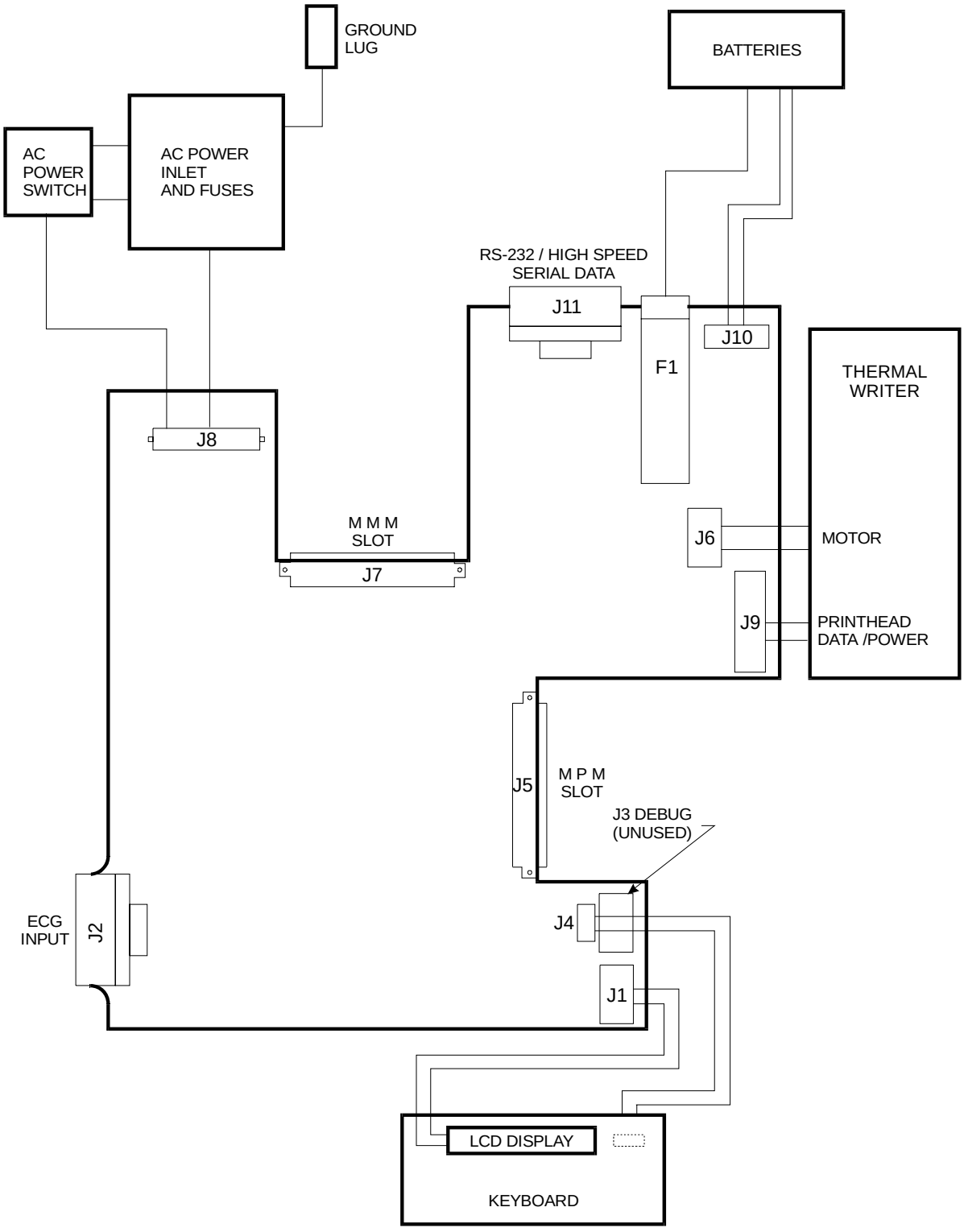
Connect the ELI 100 to AC power using the power cord provided. Turn the power switch located on the back of the ELI 100 to the ON position (1/0). The message: "CHARGING" or "AC POWER" will appear on the LCD screen. If the message "AC POWER" remains on the display, verify that the battery fuse is installed and functional. If the battery fuse is installed and functional and the display indicates "AC POWER", the batteries are fully charged.

To fully charge an ELI 100, the unit should be plugged in for approximately 8 hours, and, when fully charged, the LCD will display "AC POWER", and the ELI 100 will operate continuously for approximately 4 hours.

When approximately 30 minutes of continuous operation remain in the unit, the message: "BATTERY LOW" will appear on the LCD. When this message appears, printing is disabled, thus avoiding total battery discharge. Connecting the unit to AC makes it possible to generate printouts. However, it is recommended that you leave the unit in the CHARGING mode for some time before using it on battery power only.

Whenever possible, especially following extended use, the ELI 100 should be connected to AC Power and charged when not in use.

Interconnection Diagram 1



Interconnection List

RS-232 / High-Speed Serial Data Port

Connector:	Pin #:	Name:	Description:
J11	1	XROUT	High-Speed Data Output
	2	RX	Receive Data
	3	TX	Transmit Data
	4	DTR	Data Terminal Ready
	5	SHGND	Ground Reference
	6	ENMUX	+5V for External Module
	7	DSR	Data Set Ready
	8	CTS	Clear to Send
	9	XRIN	High-Speed Data Input

AC Power Input

Connector:	Pin #:	Name:	Description:
J8	1	AC1	T1 Primary #1
	2	AC2	T1 Primary #1
	3	AC3	T1 Primary #2
	4	AC4	T1 Primary #2
	5	THERM	AC Input (Line)
	6	ACP	AC Input (Neutral)

Battery Input

Connector:	Pin #:	Name:	Description:
J10	1	BATPLUS	Positive Battery Terminal
	2	BATNEG	Negative Battery Terminal

Writer Motor

Connector:	Pin #:	Name:	Description:
J6	1	GND	Chassis Ground
	2	VCC	5V Power for Shaft Encoder
	3	TACH	Motor Shaft Encoder Output
	4	(NC)	
	5	GND	Chassis Ground
	6	MOTOR	Writer Motor Power
	7	(NC)	
	8	(NC)	
	9	(NC)	
	10	(NC)	

Writer Control / Power

Connector:	Pin #:	Name:	Description:
J9	1	GND	Chassis Ground
	2	VHEAD	Printhead Element Power
	3	GND	Chassis Ground
	4	VHEAD	Printhead Element Power
	5	GND	Chassis Ground
	6	VHEAD	Printhead Element Power
	7	GND	Chassis Ground
	8	VHEAD	Printhead Element Power
	9	GND	Chassis Ground
	10	VHEAD	Printhead Element Power
	11	TPH_EN	Printhead Enable
	12	GND	Chassis Ground
	13	HDATA	Serial Data to Printhead
	14	GND	Chassis Ground
	15	LATCH	Printhead Data Latch Signal
	16	GND	Chassis Ground
	17	HCLK	Printhead Data Clock Signal
	18	GND	Chassis Ground
	19	STB2~	Strobe #2
	20	STB1~	Strobe #1
	21	STB4~	Strobe #4
	22	STB3~	Strobe #3
	23	STB6~	Strobe #6
	24	STB5~	Strobe #5
	25	STB7~	Strobe #7
	26	GND	Chassis Ground
	27	RTHERM1	Thermistor Connection
	28	RTHERM2	Thermistor Connection
	29	VCC	Printhead Logic Power
	30	VCC	Printhead Logic Power

Patient Input

Connector:	Pin #:	Name:	Description:
J2	1	V2	Patient Lead
	2	V3	Patient Lead
	3	V4	Patient Lead
	4	V5	Patient Lead
	5	V6	Patient Lead
	6	SHIELD	Isolated Ground
	7	(NC)	
	8	(NC)	
	9	RA	Patient Lead
	10	LA	Patient Lead
	11	LL	Patient Lead
	12	V1	Patient Lead
	13	SHIELD	Isolated Ground
	14	RL	Patient Lead
	15	(NC)	

LCD Display Interface

Connector:	Pin #:	Name:	Description:
J1	1	GND	LCD Signal / Power Return
	2	VCC	5V Power to LCD
	3	CONTR	LCD Contrast Voltage
	4	RS	LCD Register Select
	5	RW~	LCD Read / Write Control
	6	E	LCD Enable
	7	BDAT8	Data Bus Signal
	8	BDAT9	Data Bus Signal
	9	BDAT10	Data Bus Signal
	10	BDAT11	Data Bus Signal
	11	BDAT12	Data Bus Signal
	12	BDAT13	Data Bus Signal
	13	BDAT14	Data Bus Signal
	14	BDAT15	Data Bus Signal

Spare Slot

Connector:	Pin #:	Name:	Description:
J7	96	Pin Connector	Refer to Schematic

MPM Board Slot

Connector:	Pin #:	Name:	Description:
J5	96	Pin Connector	Refer to Schematic

Keyboard Interface

Connector:	Pin #:	Name:	Description:
J4	1	Row 1	Keyboard Row
	2	Row 2	Keyboard Row
	3	Row 3	Keyboard Row
	4	Row 4	Keyboard Row
	5	Row 5	Keyboard Row
	6	Row 6	Keyboard Row
	7	Row 7	Keyboard Row
	8	Row 8	Keyboard Row
	9	COL 1	Keyboard Column
	10	COL 2	Keyboard Column
	11	COL 3	Keyboard Column
	12	COL 4	Keyboard Column
	13	COL 5	Keyboard Column
	14	COL 6	Keyboard Column
	15	COL 7	Keyboard Column
	16	COL 8	Keyboard Column

Engineering Debugger Interface

Connector:	Pin #:	Name:	Description:
J3			
	1	GND	System Ground
	2	DSCLK	Engineering Debugger SUPPORT
	3	GND	System Ground
	4	FREEZE	Engineering Debugger SUPPORT
	5	RESETn	System Reset
	6	DSI	Engineering Debugger SUPPORT
	7	VCC	5V Power
	8	DSO	Engineering Debugger SUPPORT

4 Final Assembly

Parts List #1

QTY:	DESCRIPTION: 34000-015-1000, 1001, 1006, AND 1011	PART NUMBER:	ITEM:
2	Fuse Type T 250V 315mA 5 x 20 Slo-Blo	4021-003	2
2	Fuse Carrier 5 x 20mm Black	4115-008	4
1	Keyboard 46 Key Assembly Domestic	4160-012-50	5
	or		
1	Keyboard 46 Key Assembly International	4160-012-52	6
5	Screw Phillips Panhead M3 x 6	6020-430	7
2	Screw Phillips Flathead M3 x 6 Black Oxide	6020-731	8
6	Screw Phillips Flathead M3 x 8 Black Oxide Plating	6020-733	9
3	Screw Sems M3 x 12 with 2 Captive Washers	6024-006	10
2	Screw M3 x 6 with Captive Lock Washer	6024-001	11
6	Screw M3 x 6 with 2 Captive Lock Washers	6024-003	12
5	Nut with Captive Spring Washer M3	6152-001-01	13
1	Keyboard Grounding Plate	8483-013-01	14
1	Closing Plate for Modem	8551-027-50	15
1	Plastic Release Handle Painted	11800-001-50	16
1	Door Molded Painted	11800-002-50	17
1	Cover Assembly with Silkscreen - Domestic	11800-009-51	18
	or		
1	Cover Assembly with Silkscreen International	11800-009-52	19
1	LCD Assembly 2 x 40 & 2 x 7 RA Conn	14000-004-50	22
1	4" Writer Assembly	22500-100-50	23
1	Ribbon Cable Assembly LCD to Board	25018-010-50	24
1	Ribbon Cable Assembly Head to Board	25018-011-50	25
1	Wire Ground	25020-040-50	26
18.75	Tape Two-Sided Adhesive 0.009 Thick x 0.25 Wide	7401-002	27
1	Base Assembly Standard Version	33999-003-50	28
1	Mylar Shield Modem Panel	8040-025-01	29
10	Washer Flat M3 9mm O.D.	6106-130	30
1	Grounding Post, Thumb Nut 1/4-32 - AAMI	6191-003	31
1	Grounding Post m6 x 1 Stud - IEC	6191-002-01	32
2	Lock Washer Steel External 1/4	6100-025	33
1	Washer Flat M6	6106-060	34
2	Nut Hex Steel 1/4-32	6150-432	35
2	Nut Hex Steel M6	6152-060	36
1	MPM 2MRAM 1RCV/GA Printed Circuit Board (Std)	26025-005-50	37
	or		
1	MPM 16MRAM 2RCV/GA Printed Circuit Board (STM)	26025-005-51	38
1	Screw Phillips Pan M3 x 14 Steel Zinc Plated	6005-007	39
1	Label Protective Earth (Ground)	9025-018-01	40
1	Label UL Classification	9025-019-01	43

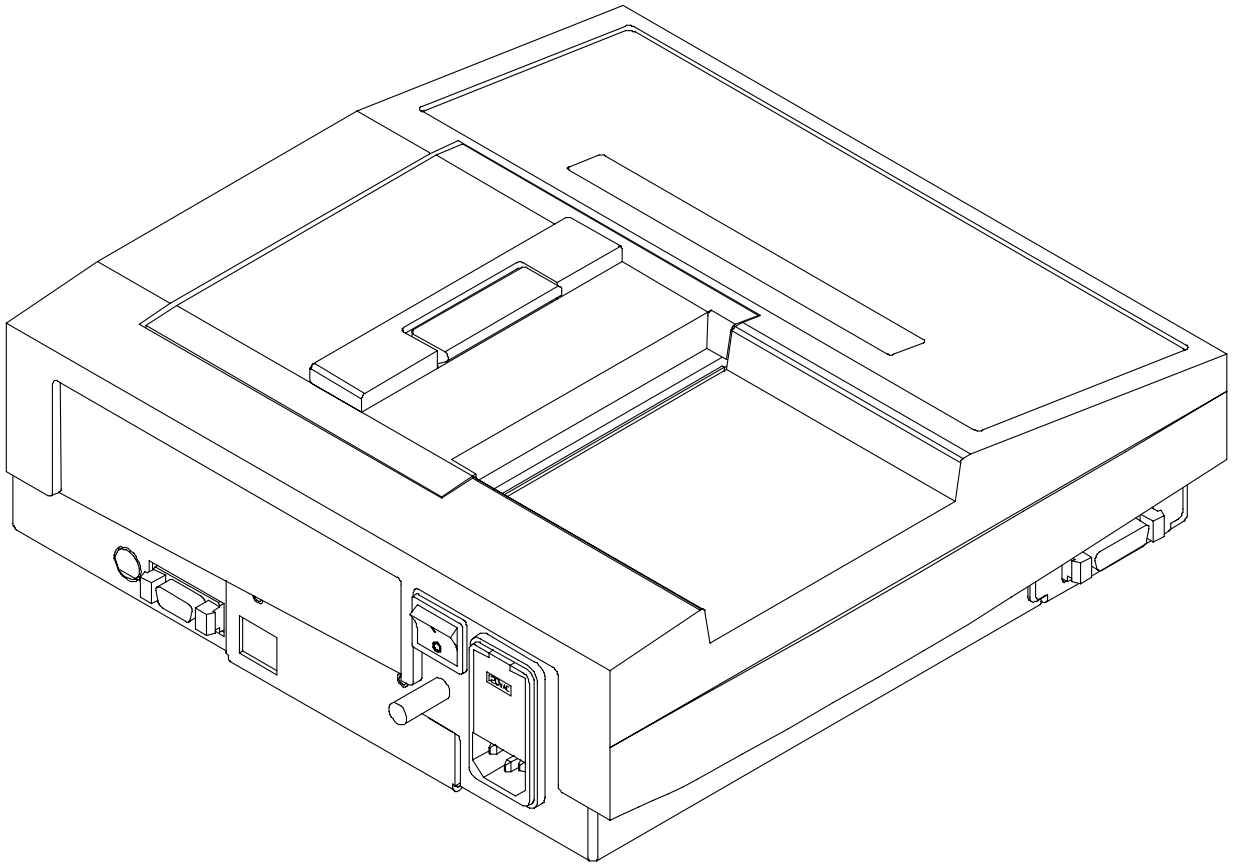


Figure 4-a Completed Final Assembly

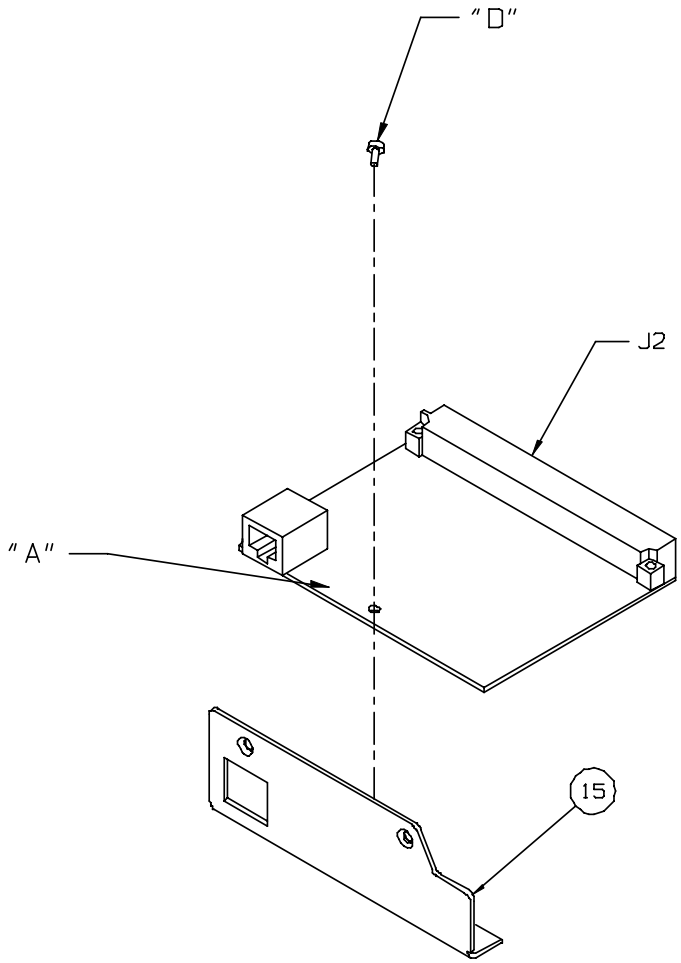


Figure 4-b Assembling Modem Card

Modem Card optional Assembly Procedure:

(For Production of 41000-007-51 Modem Kit Domestic)

- Remove the modem Closing Plate (Item 15), located at the back of the unit, from the base by removing the 2 Screws
  (Item 8). Shown on next page.
- Attach new Label (Item E and/or K), using caution to align the cutout for the phone jack and the clearance holes for screws.
- Attach the Modem Card (Item A) to the modem closing plate (as shown) with 1 Screw (Item D).
- Slide the modem card and closing plate back into the assembly until the connectors mate and secure the modem closing plate back onto the assembly with the 2 Screws (Item 8).

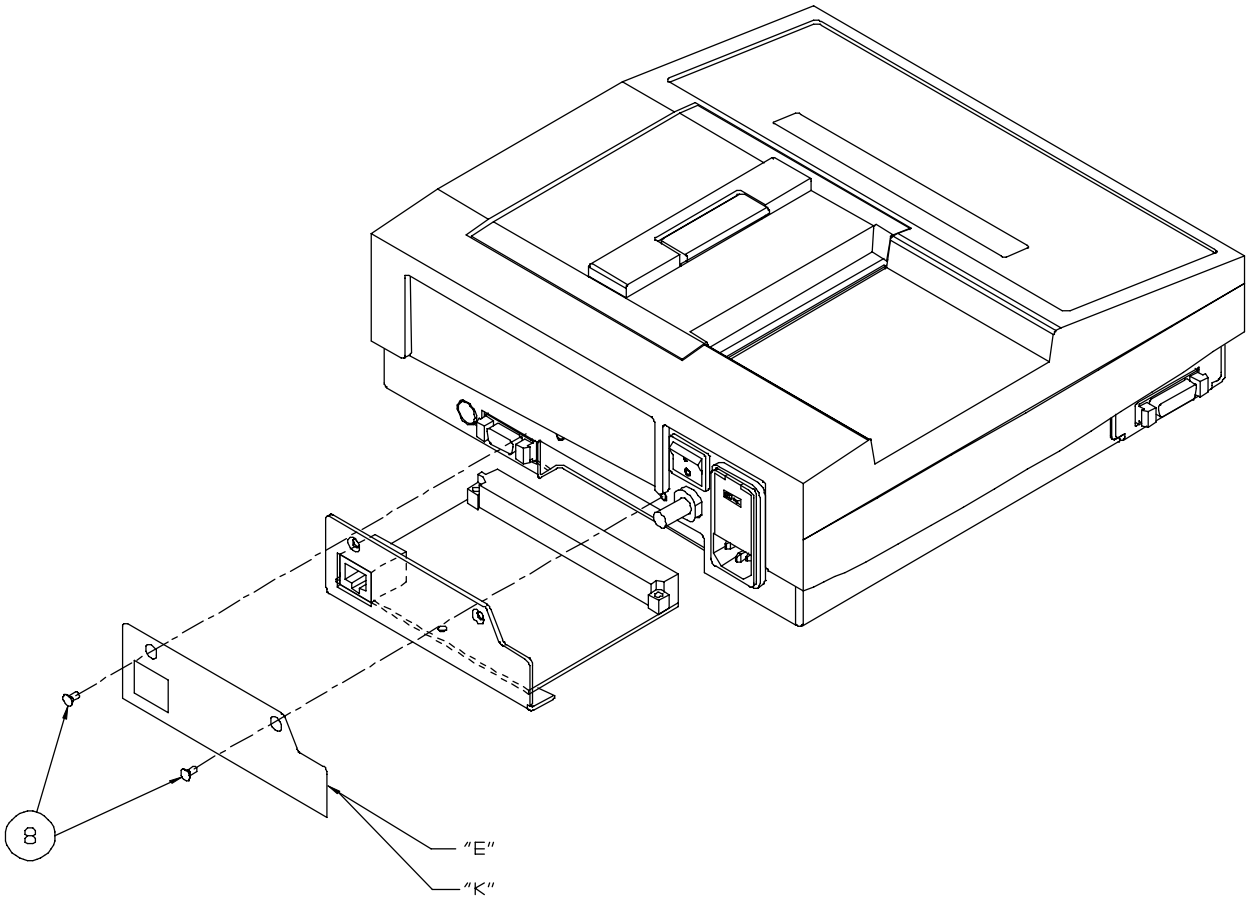


Figure 4-c Modem Installation

Modem Options:

Reference Bill of Materials:

41000-007-50	Field Installed Modem Kit Domestic
41000-007-51	Factory Installed Modem Kit Domestic
41000-007-52	Factory Installed Australian Modem Kit
41000-007-55	Field Installed Modem Kit EC / International
41000-007-56	Factory Installed Modem EC/ International

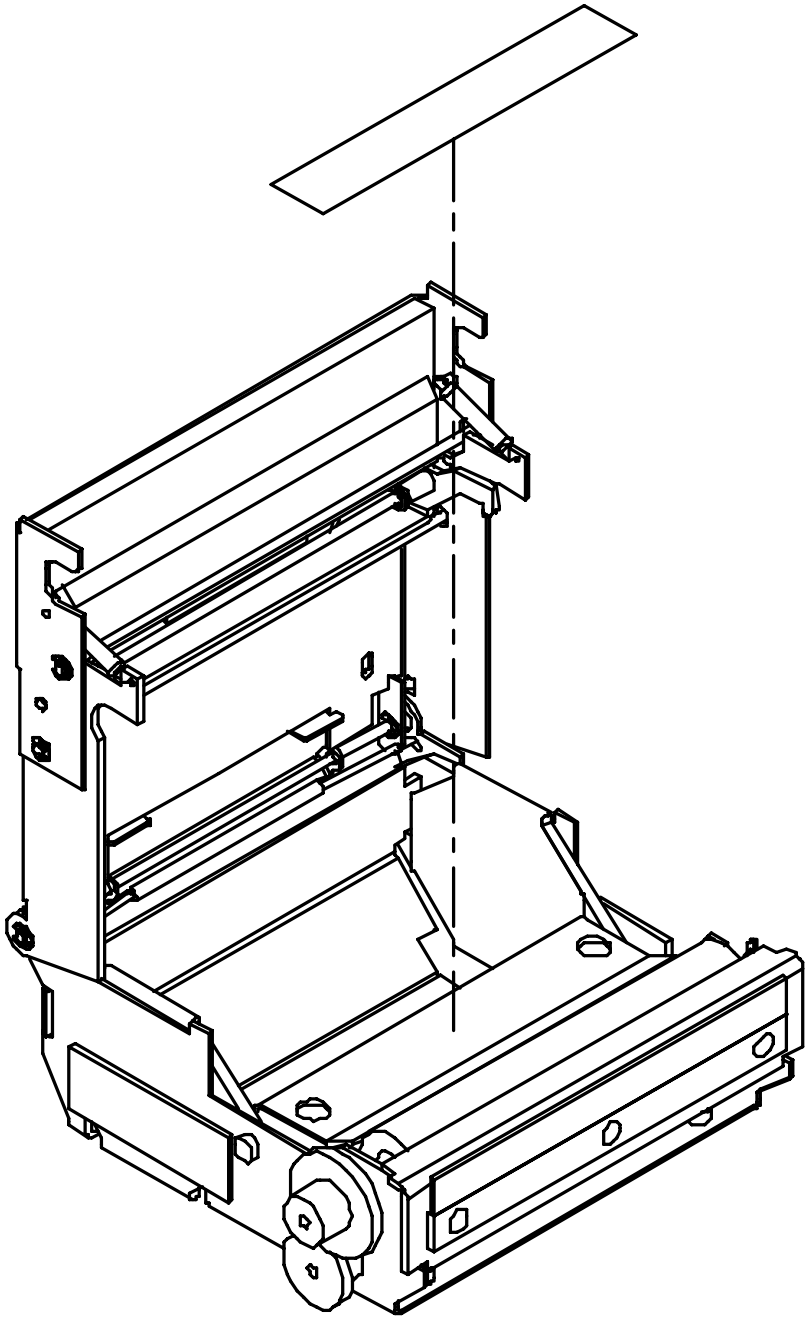


Figure 4-d Label Placement on Writer

Place Label (Item D) on writer as shown. See Label Chart in following pages.

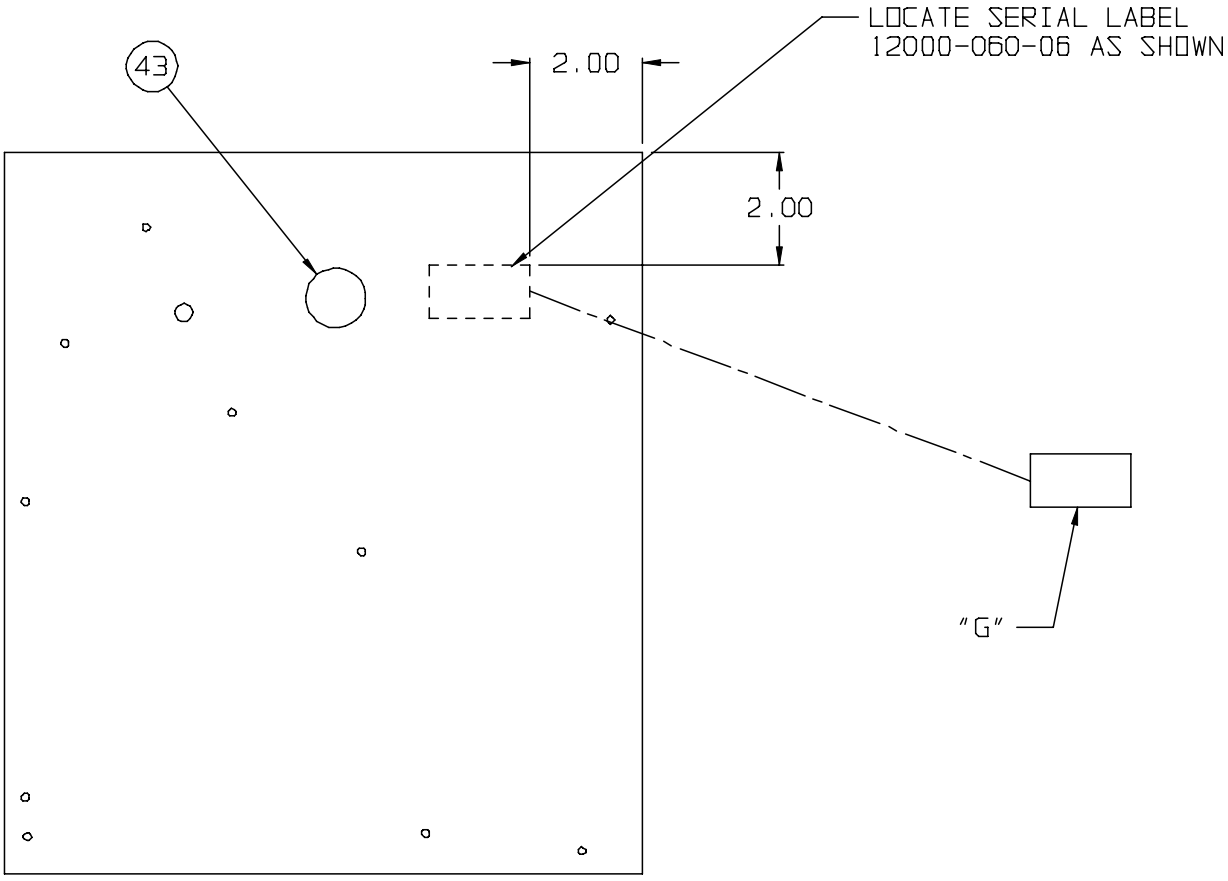


Figure 4-e Serial Number and Part Number Label Placement on Bottom of Unit.

Attach Serial Number and Part Number label (G) as shown above. See Label Chart in following pages.

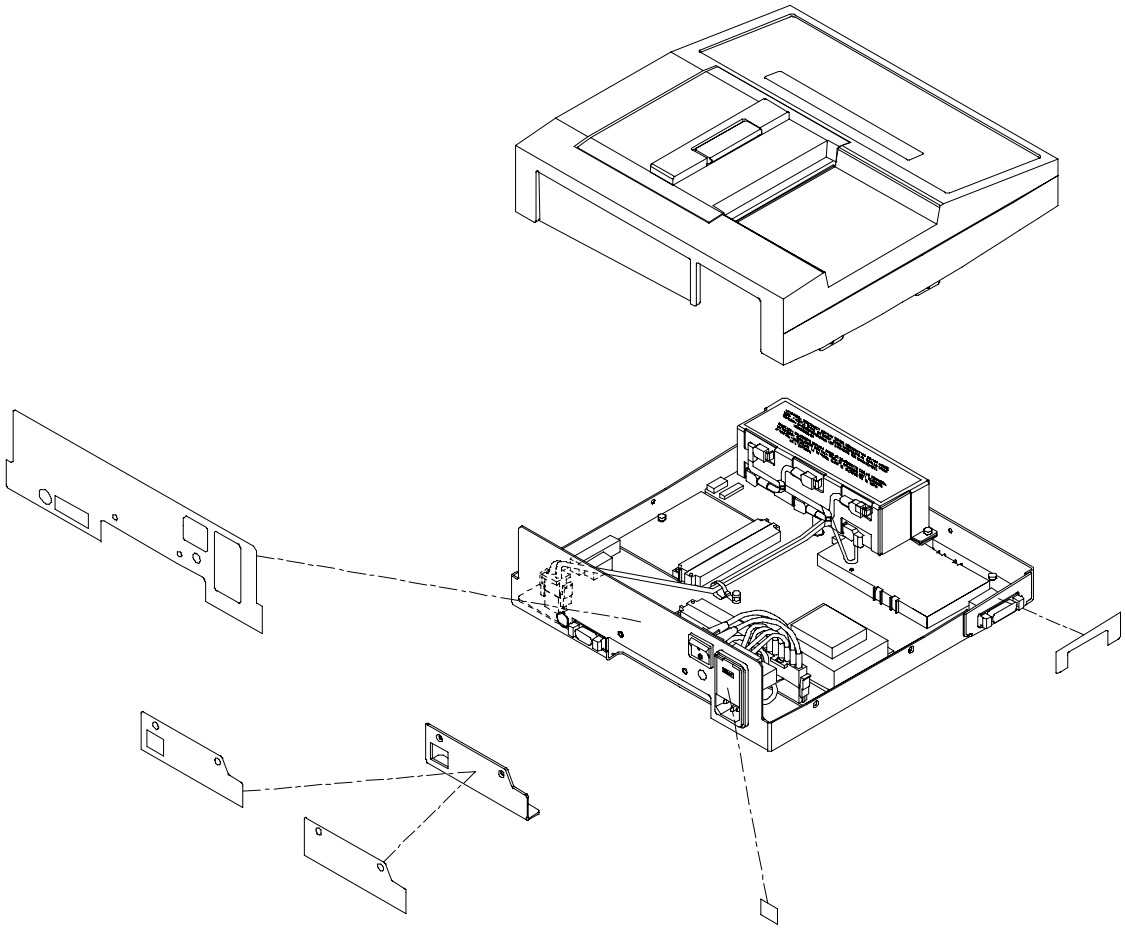


Figure 4-f Label Placement on Unit.

ITEM	LABEL SET P/N:12000-060-50		ASSEMBLY USED ON:		
	PART NUMBER:	LOCATION:	34000-015 -XXXX	33999-003 -50	41000-010 -50/-52
A	12000-060-01	REAR BASE	X ALL		
B	12000-060-02	BATTERY BRACKET		X ALL	
C	12000-060-04	BATTERY BRACKET		X ALL	
D	12000-060-05	PAPER TROUGH	X ALL		
E	12000-060-08	REAR W/MODEM FCC	X D		
F	12000-060-09	REAR W/O MODEM	X ALL		
G	12000-060-06	SERIAL / REF	X ALL		
H	12000-060-07	ECG INPUTS	X ALL		
I	12000-060-03	FUSE	X ALL		
J	FUSE/ENVELOPE/LABEL TAPE TO TOP OF UNIT		1		
K	12000-060-10	MODEM W/O FCC	X CE/I		
L	12000-060-11	MRM-2500 W/ FCC			X D
M	12000-060-12	MRM-2500 W/O FCC			X CE/I
N	12000-060-13	MRM-915 W/ FCC			X D
P	12000-060-14	MRM-915 W/O FCC			X I

D = DOMESTIC
I = INTERNATIONAL OUTSIDE OF EUROPE (CE)
CE = EUROPE COMMUNITY
ALL = ANY ABOVE

Fig 4-g Label Chart

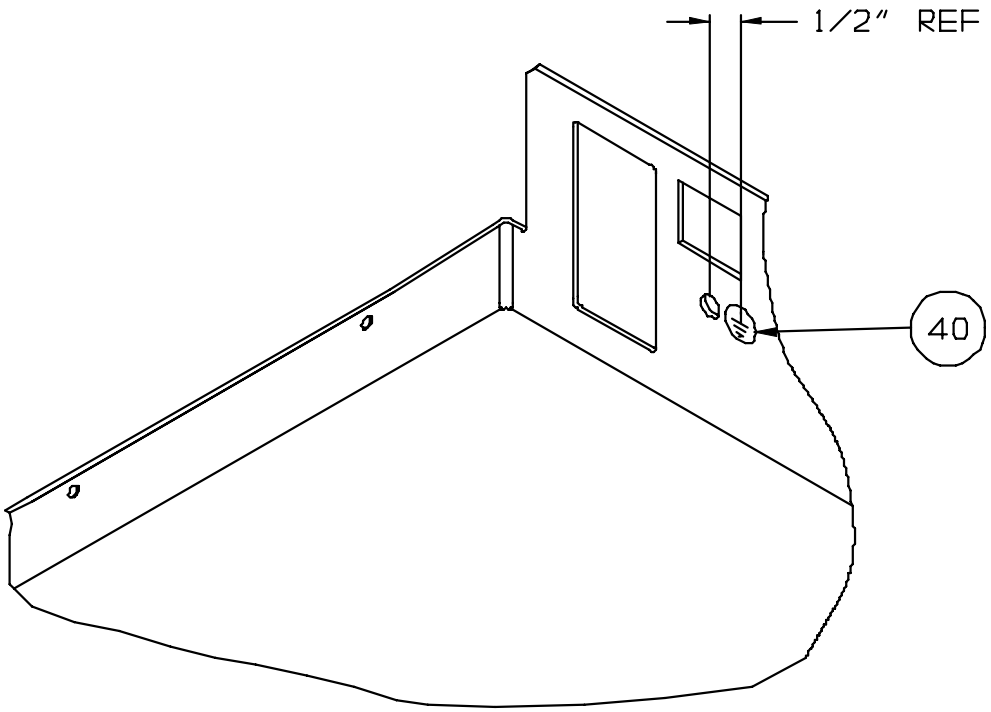


Figure 4-h Ground Label Placement on Unit.

Install Protective Earth Ground Label adjacent to ground post as shown above. Refer to parts lists on page 1 this section.

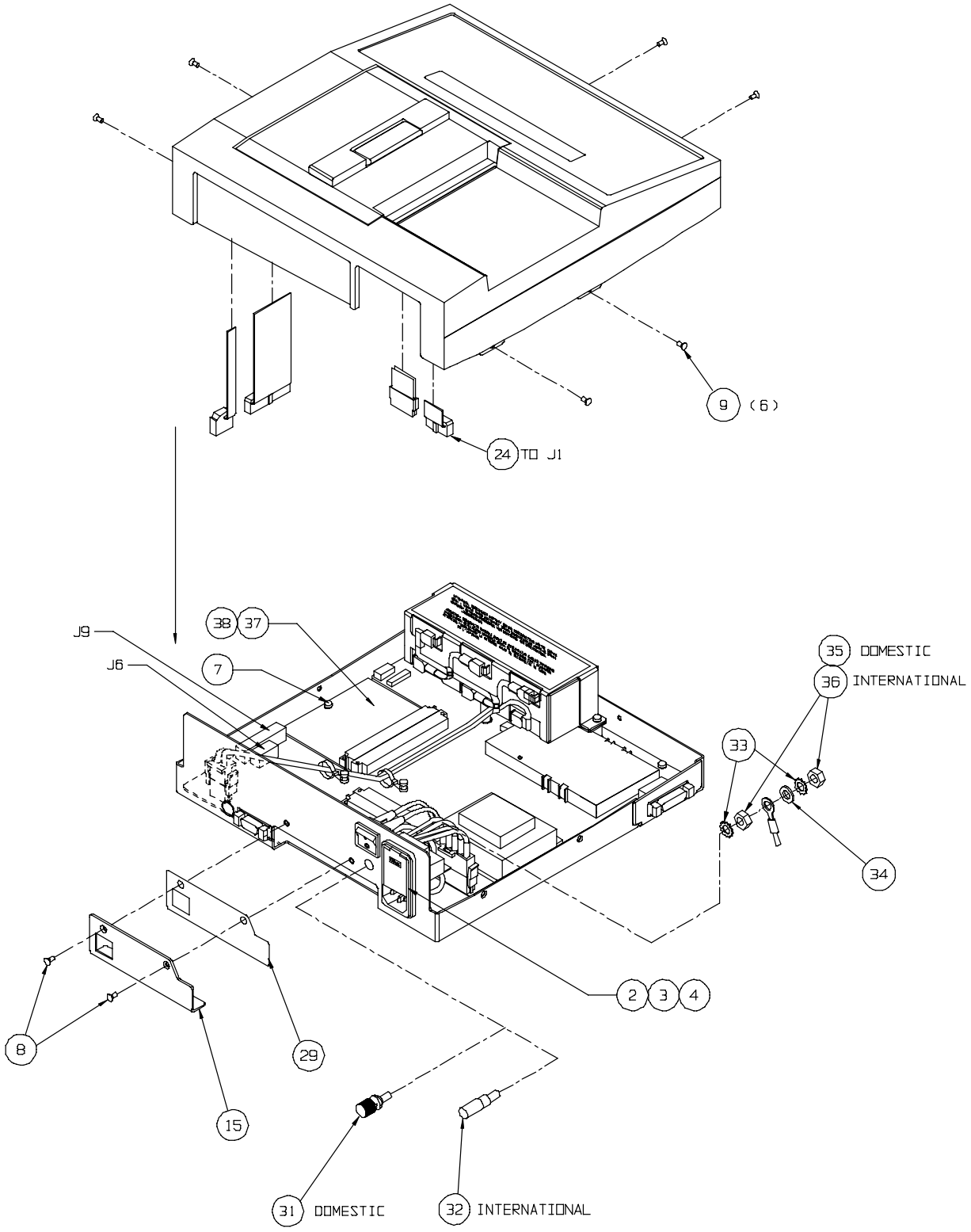


Figure 4-i Cover on Base Installation, see notes on next page.

Assembly notes:

Attach the following cables from the cover to the base in the following order:

- Connect cable from the cover LCD Display to J1 on the base printed circuit board.
- Connect cable from the cover Keyboard to J4 on the base printed circuit board.
- Connect cable from the Writer Motor to J6 on the base printed circuit board.
- Connect cable from the Writer Printhead to J9 on the base printed circuit board.

Install MPM Board (Item 37 or 38) into Main Board using a M3 x 6 Screw (Item 7).
Position cover over base and close onto base. Secure to base with 6 Screws (Item 9) tighten to hand tight.
Remove paper backing from Mylar Shield (Item 29) and adhere to Modem Cover Plate (Item 15).
Place Modem Cover Plate (Item 15) over modem opening and secure into place with 2 Screws (Item 8), tighten to hand tight.

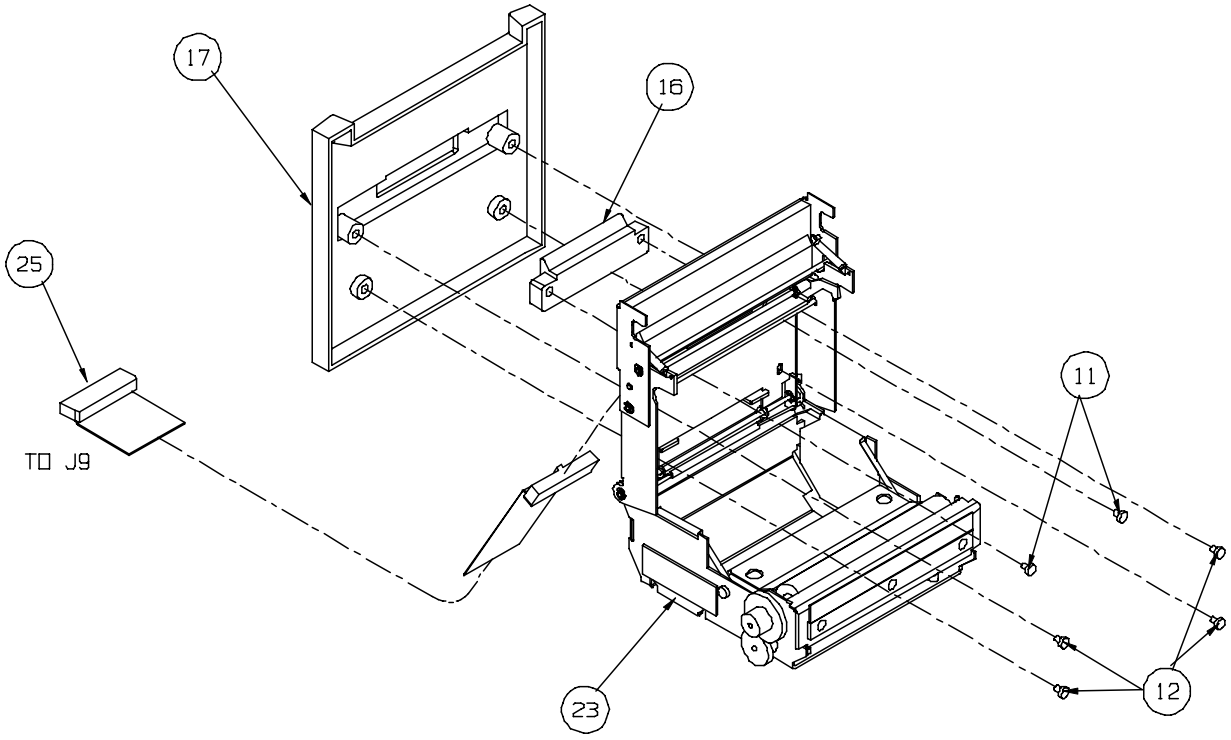


Figure 4-j Writer Door Installation

Attach Ribbon Cable (Head to Board, Item 25) to writer printhead.
Attach Release Button (Item 16) to writer with 2 Screws (item 11).
Attach writer Door (Item 17) using 4 Screws (Item 12) as shown, leave them loose at this time.

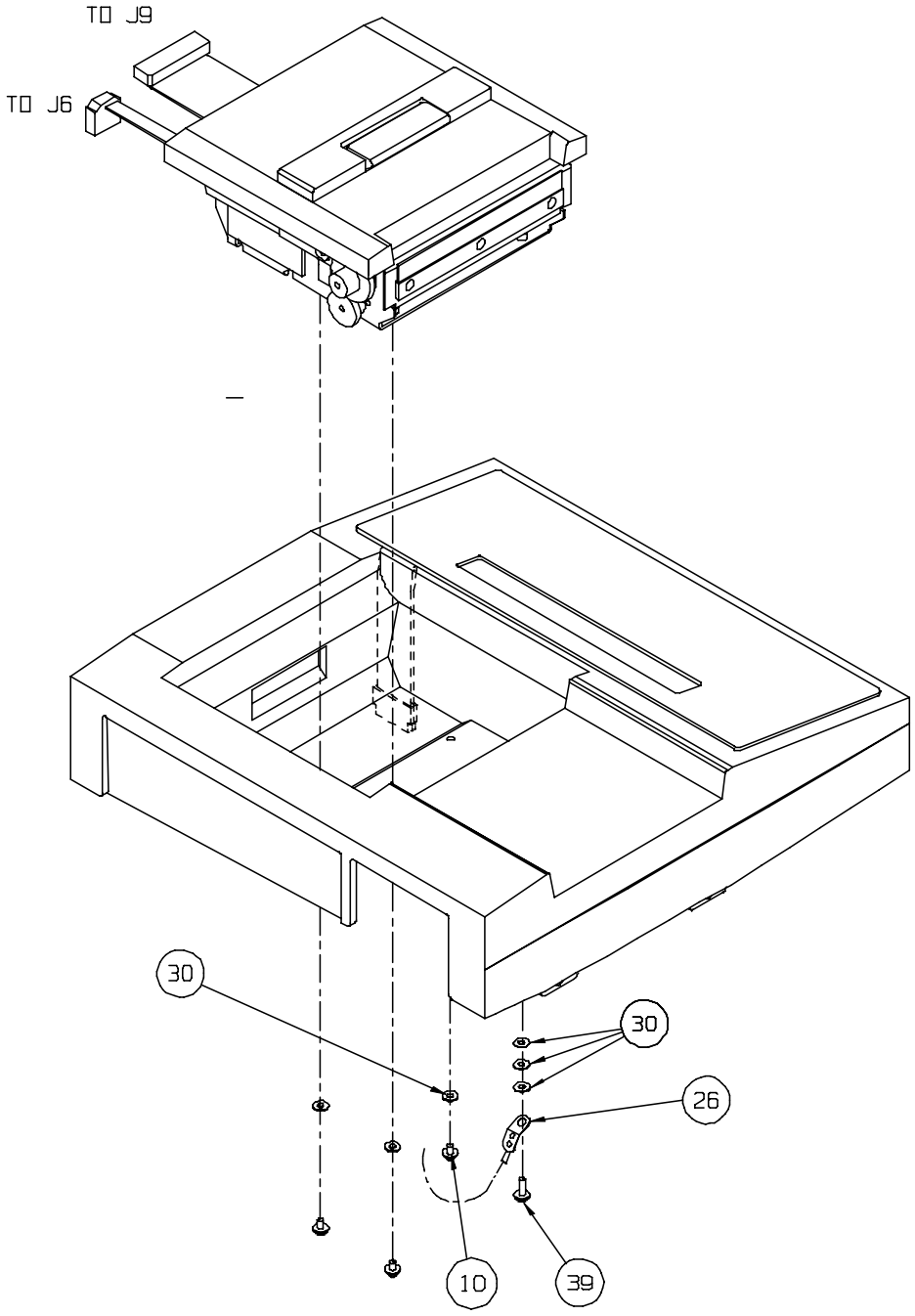


Figure 4-k Writer Installation

Center assembled writer evenly on both sides opening.
Secure the writer to the cover using 4 Screws (Item 10 and 39), 6 Flat Washers (Item 30); stack 3 under ground lug.
Add Lug of Ground Cable Assembly (Item 26) on the screw toward the left front corner of the cover.

Note: The Ground Cable Assembly (Item 26) runs between the Keyboard Stud and the Writer Stud.

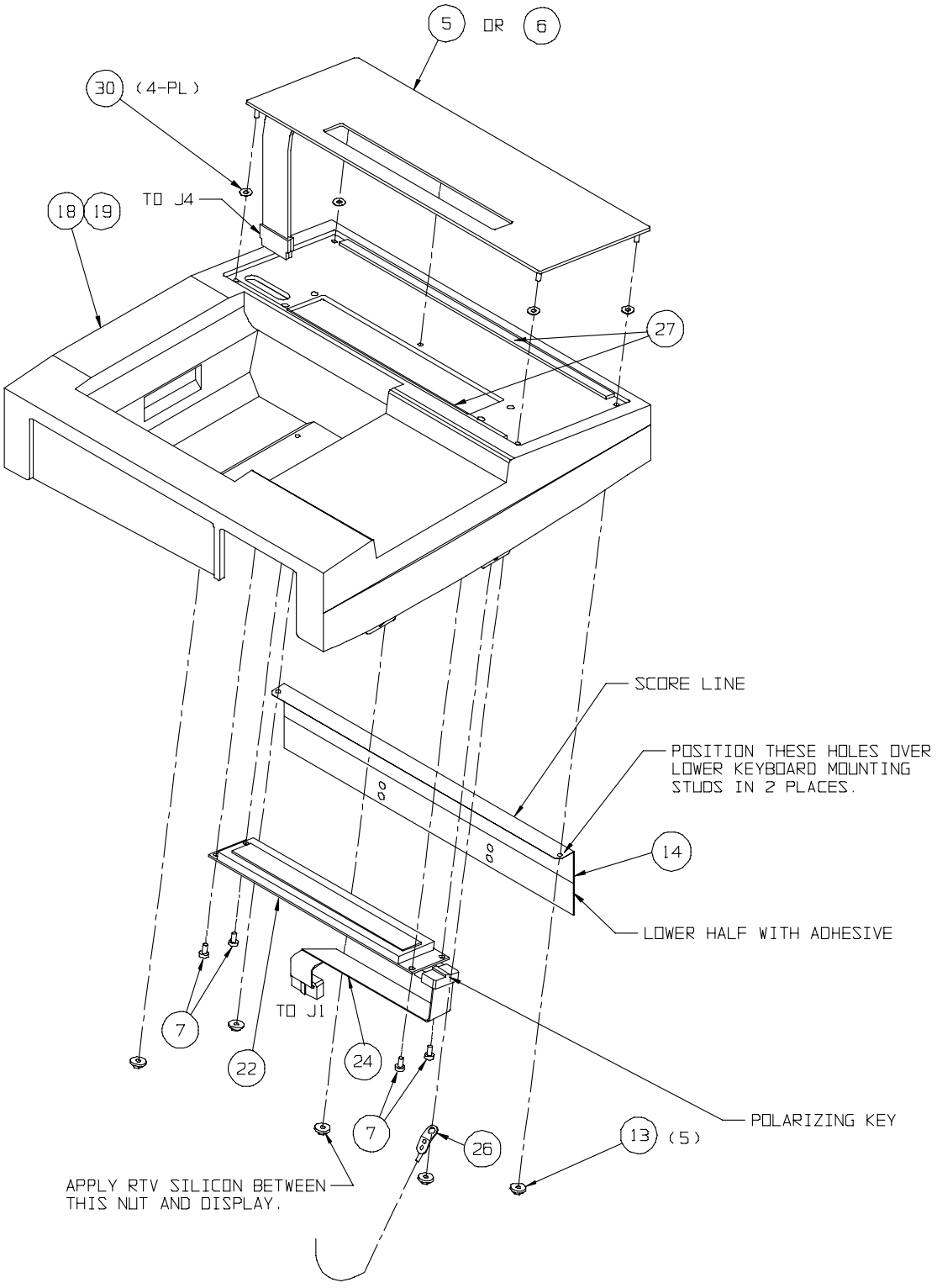


Figure 4-l LCD and Keyboard Installation

Mount the LCD Display Assembly (Item 22) to the underside of the cover with 4 Screws (Item 7).

Note: The polarizing key must be assembled up towards the cover.

Plug the LCD Ribbon Cable (Item 24) into the end of the LCD Assembly (Item 22) with polarizing key oriented as shown in view on previous page.

Note: Clean display window with isopropyl alcohol or window cleaner and a cotton cloth after installation.

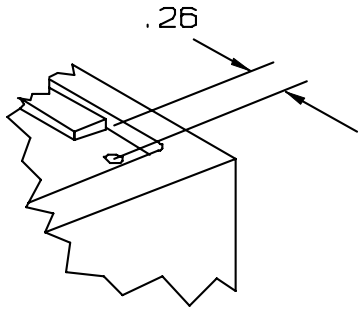


Figure 4-m Tape Placement

Cut Double-Sided Tape (Item 27) in 2 pieces to 9.375" long, to fasten keyboard to the cover. Remove release liner from one side and align at the distance shown above, from center of keyboard mounting hole and against top and bottom edges of keyboard mounting well.
Lay Washers (Item 30) on top of the cover, align with the four corner keyboard studs and remove release liner from the other side of the double-sided tape, before pressing Keyboard (Item 5 or 6) in place. Sliding keyboard ribbon cable (to J4) through cover as you do so.
After creasing along score line and flowing it to about 90°, peel release liner from bottom edge of Keyboard Ground Plate (Item 14). Align bottom pair of holes in Keyboard Ground Plate (Item 14) with holes in tabs on the cover and adhere to outside surface. Wrap Keyboard Ground Plate (Item 14) around tabs (toward the inside of the cover) aligning over the holes and adhering to the tabs and to itself. Align the remaining holes with the front two studs of keyboard.

Note: Holes in Keyboard Ground Plate (Item 14) must align with holes in tabs of cover.

Install (5) M3 Nuts (Item 13) with captive lockwashers to keyboard studs, using silicone RTV to cover and insulate center nut and washer.

Plug in cables:

- Narrow (Motor) ribbon to J6
- Wider Writer ribbon to J9
- Keyboard ribbons to J4
- Plug AC Power Connector into J8
- LCD to J1
- Battery cable into J10

Complete cable tie installation.

Tighten Door screws, which were left loose (Item 10 and 39). Attach cover to base with 6 black screws (Item 8).
Attach any remaining labels, following the Label chart shown previously.
Install Fuses: Two Fuses and carrier for AC Power and one Fuse and Holder for Battery Power. Run self test at this time.

5 Base Assembly

Parts List #2

QTY:	DESCRIPTION: 33999-003-50	PART NUMBER:	ITEM:
1	Chassis Assembly	8483-009-50	1
1	ELI 100A PCB	26025-002-50	2
1	Collar Patient Connector	8483-010-01	4
1	Battery Bracket Assembly	8551-026-50	5
1	Cable Assembly AC Switch & Leads	14050-012-51	6
1	Connector AC & Leads	14050-011-51	7
2	Cable Battery To Battery	25020-032-50	8
5	Cable Tie Locking 3.9 x .10	7495-001	9
1	Cable Battery To PCB	25020-041-50	10
3	Battery Rechargeble 6 Volt 1.0 Amp	4800-003	11
1.50	Tape, Rubber Black 4.5” Wide	7400-005	12
4	Bumper Round Screw Mount 5/8 x 9/32	7450-002	13
2	Screw M3 x 8 W/2 Captive Lock Washer	6024-004	14
5	Screw Phillips Panhead M3 x 6	6020-430	15
2	Stand-Off ¼ x ¾ #8-32 Aluminum-Female	6180-055	16
2	Washer, Lock, Split, M4	6105-040	17
2	Screw, Phillips Fillister 8-32 x .5	6000-800	18
4	Screw, Phillips Panhead M3 x 5 Zinc Plated	6020-530	20
1	Mylar Shield	8040-023-01	21
1	Fuse, Type T, 250V, 2A, 5 x 20mm, SLO	4021-004	22
1	Fuse Carrier 5 x 20mm Black	4115-004	23
1	Label Set CE/MDD	12000-060-50B	
2	Cable Tie, Screw Mounting, 4.5 x .10	7495-004	27
2	Screw Phillip Fillister M3 x 8	6020-830	28

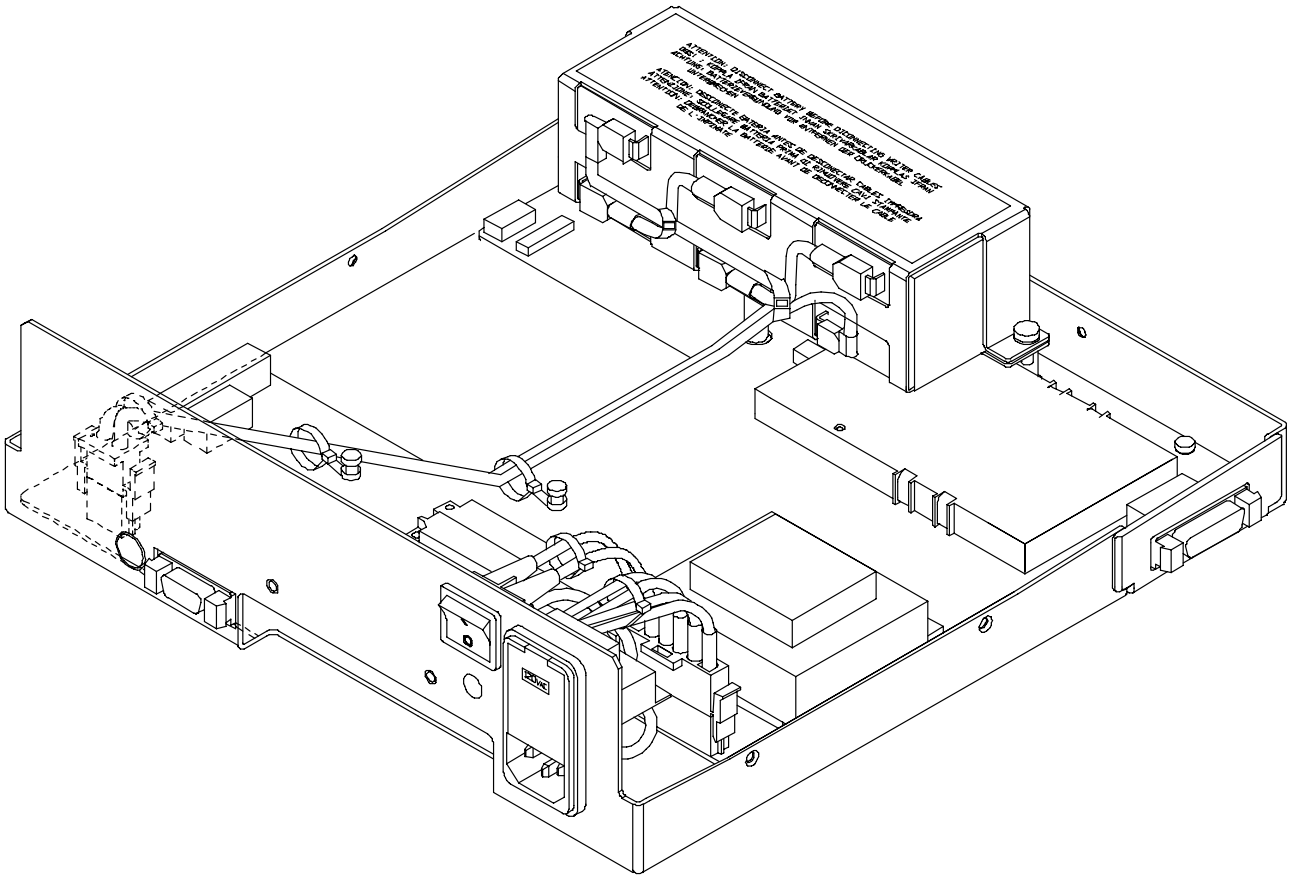


Figure 5-a Complete Base Assembly

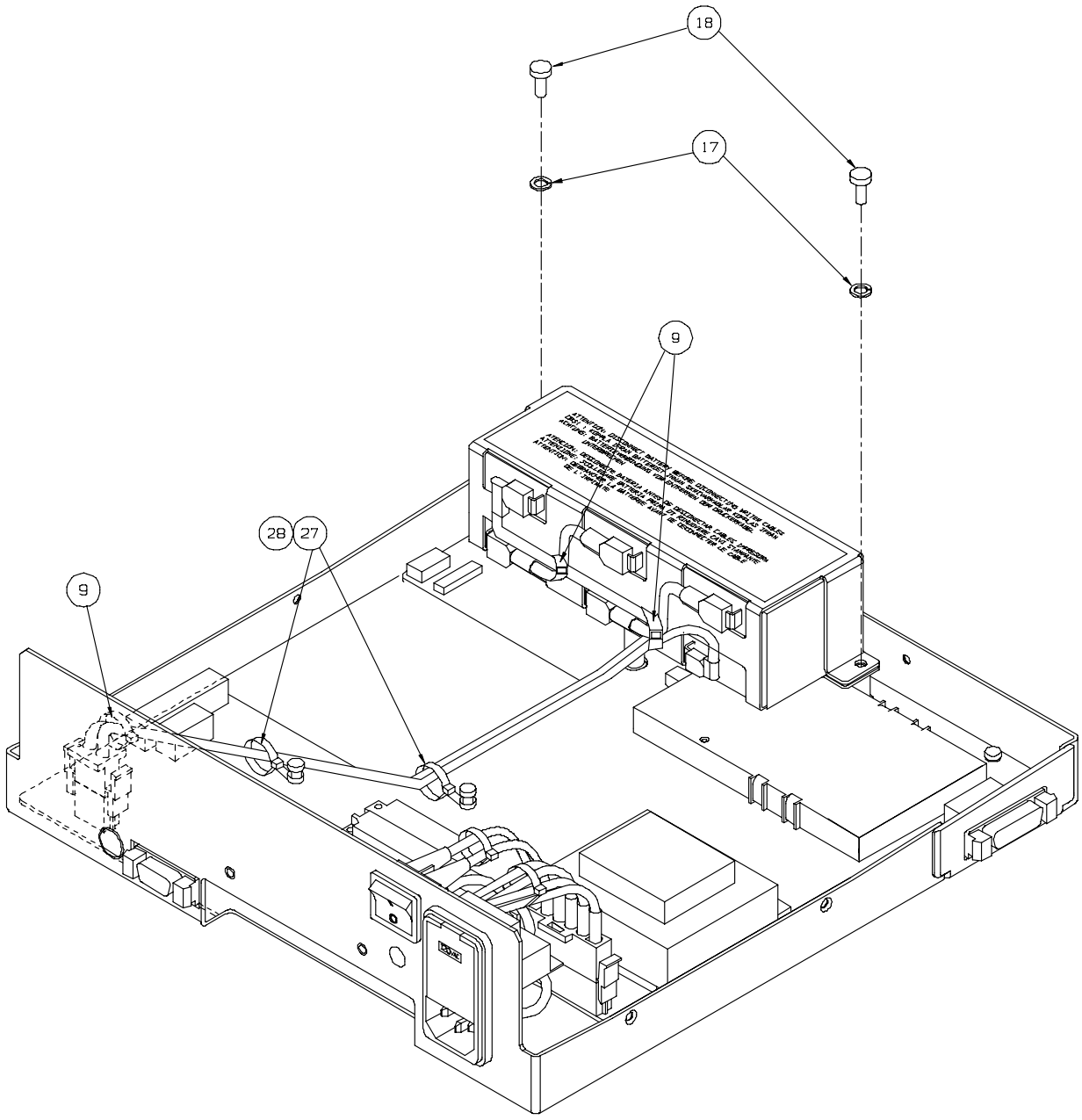


Figure 5-b Installing Tie Downs

Install Cable Ties (Item 9) as shown

Install completed battery assembly using 2 Screws (Item 18) and 2 Lockwashers (Item 17).

Install Tie Wraps (Item 27) around wires from battery to board with Screws (Item 28).

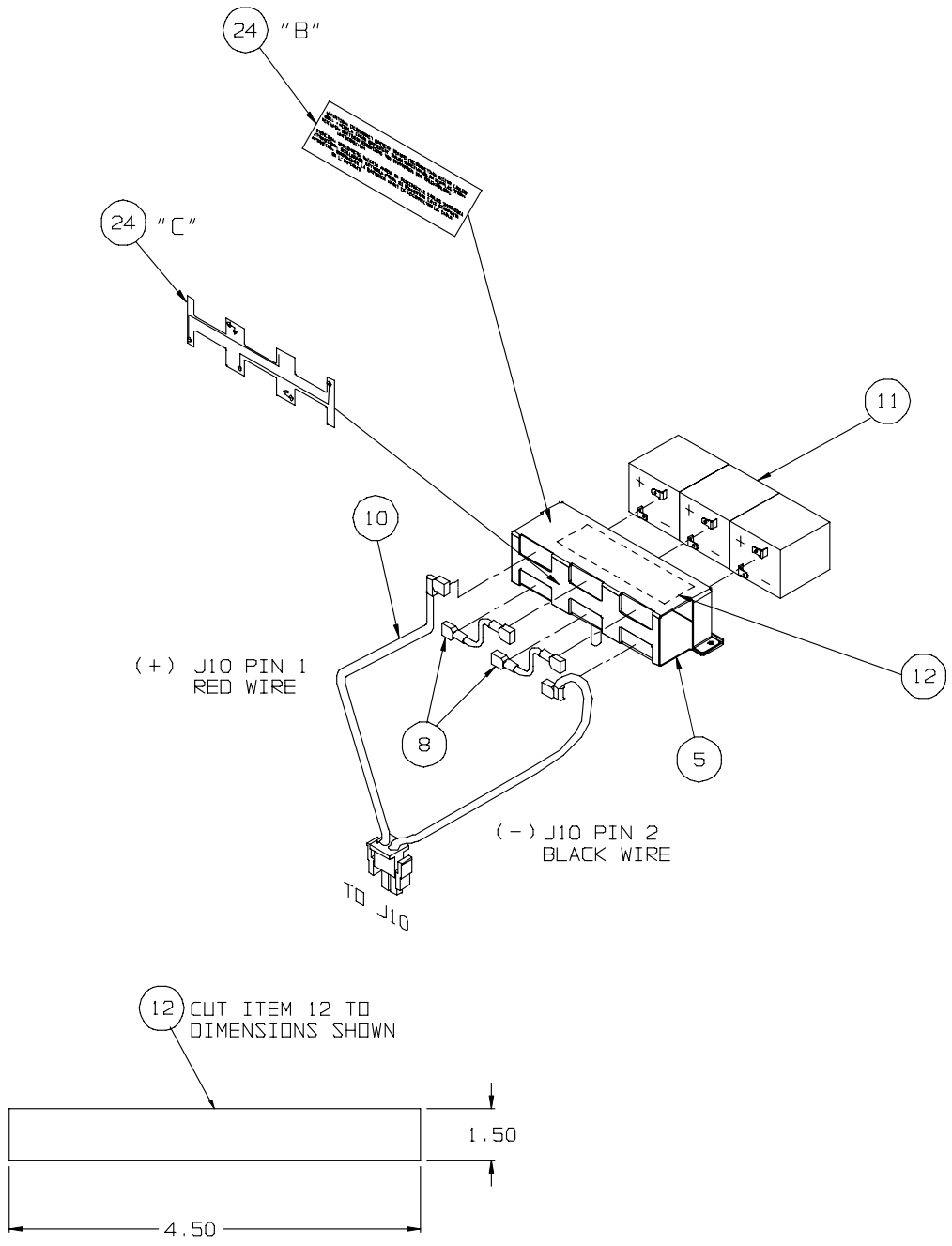


Figure 5-c Labeling and Assembly of Batteries

Place labels from Label Set (Item 24) onto battery bracket as shown. The connection diagram label is 12000-060-04 and the disconnect label is 12000-060-02. Refer to Final assembly for items "B" and "C" and label set.

Cut Tape (Item 12) to dimensions shown. Place tape inside Battery Bracket (Item 5) as shown

Insert three Batteries (Item 11) with positive terminals up (away from side with standoffs) as shown.

Install Wires (Item 8 and 10) per diagram on battery label.

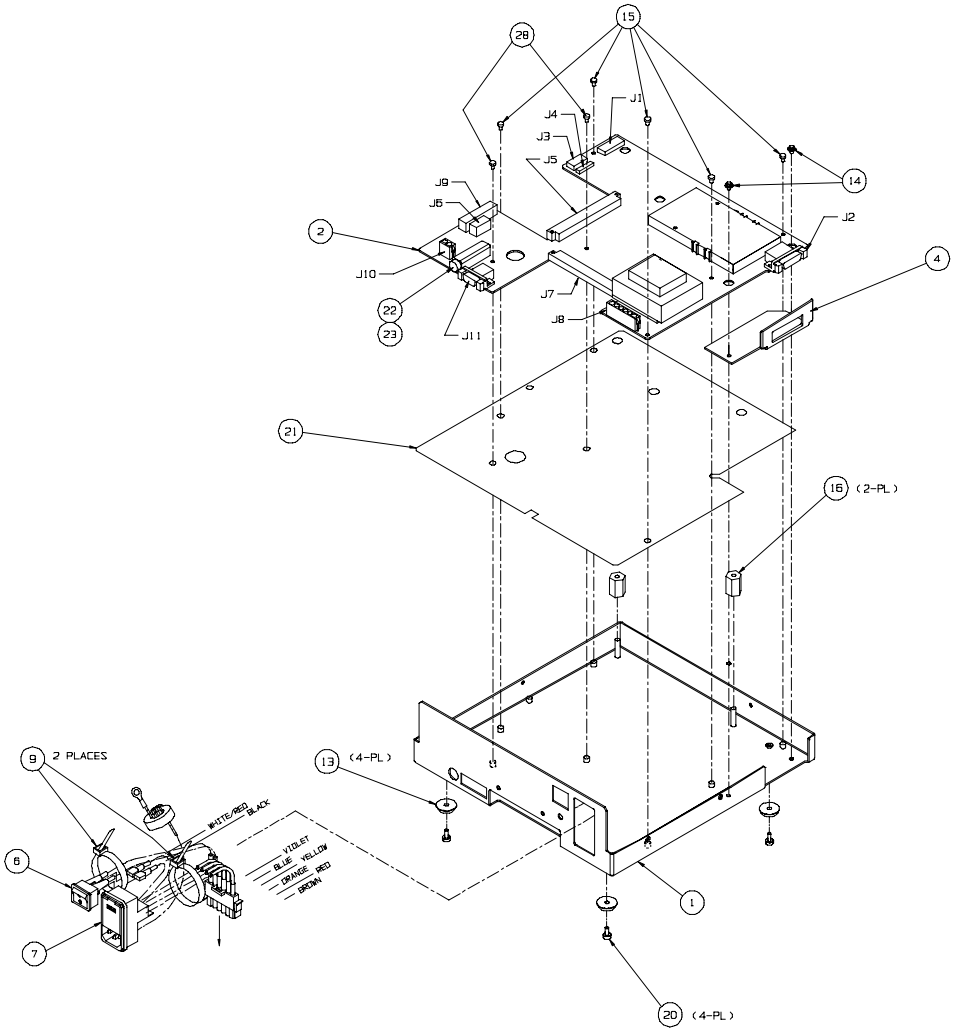


Figure 5-d Installing Printed Circuit Board

Install Feet (Item 13) on Base (Item 1) using Phillips Screw (Item 20).

Insert AC Switch Assembly (Item 6) and AC Connector (Item 7) as shown. Snap blue lead from AC Switch (Item 6) into Connector Assembly (Item 7) Pin 5 and the violet lead into connector pin 6. Attach connector from AC assembly to mating connector J8 on the printed circuit board. Install and attach ground wire to grounding post.

Ground post to be determined at top level.

Install Mylar insulating Shield (Item 21) over posts on base as shown.

Position Connector Collar (Item 4) over connector J2 on Printed Circuit Board (Item 2).

Place printed circuit board into base as shown and secure with Hardware (Item 15).

Attach Patient Connector Collar (Item 4) to floor of base through holes in printed circuit board using 2 Screws (Item 14).

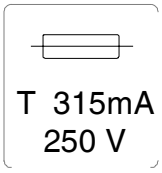
Check that patient cable connector fits properly; if not, reposition boards and retighten screws.

Components of Label Set

-01 Rear Label

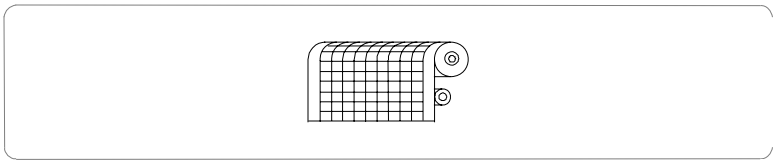
ATTENTION: DISCONNECT BATTERY BEFORE DISCONNECTING WRITER CABLES.
OBS! : KOPPLA IFRÅN BATTERIET INNAN SKRIVARKABLAR KOPPLAS IFRÅN.
ACHTUNG: BATTERIEVERBINDUNG VOR ENTFERNEN DER DRUCKERKABEL UNTERBRECHEN.
ATENCION: DESCONECTE BATERIA ANTES DE DESCONECTAR CABLES IMPRESORA.
ATTENZIONE: SCOLLEGARE BATTERIA PRIMA DI RIMUOVERE CAVI STAMPANTE.
ATTENTION: DEBRANCHER LA BATTERIE AVANT DE DECONNECTOR LE CABLE DE L'IMPRIMANTE.

-02 Battery Disconnect Warning Label

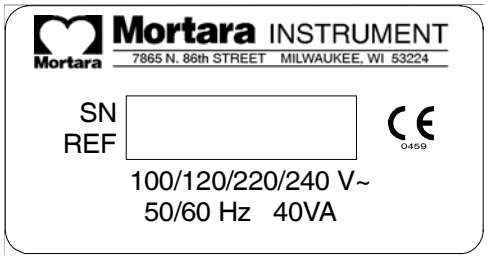


-03 Fuse Rating Label

-04 Battery Connection Guide Label

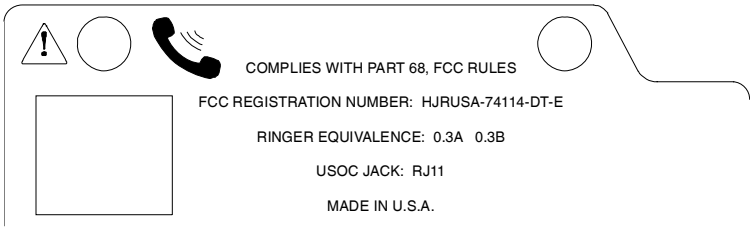


-05 Paper Trough Label



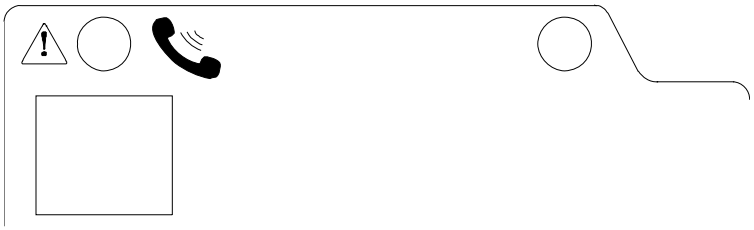
-06 Serial Number Window Label

-07 ECG Input Label

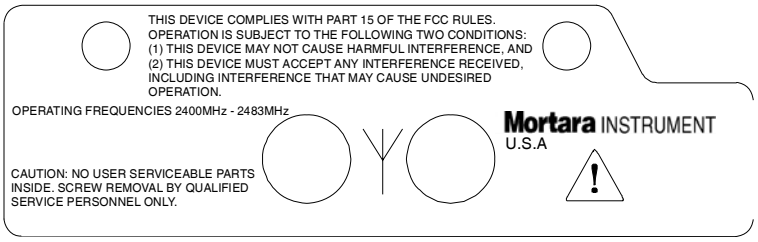

COMPLIES WITH PART 68, FCC RULES
FCC REGISTRATION NUMBER: HJRUSA-74114-DT-E
RINGER EQUIVALENCE: 0.3A 0.3B
USOC JACK: RJ11
MADE IN U.S.A.

-08 Closing Plate with Modem Label

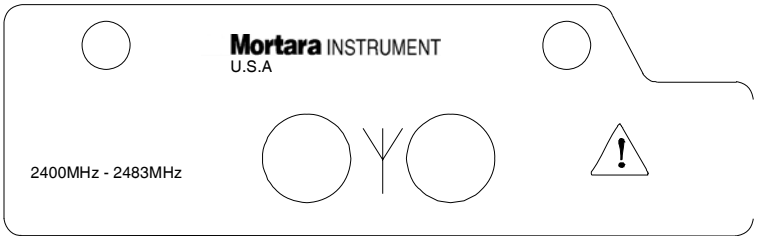
-09 Closing Plate without Modem Label



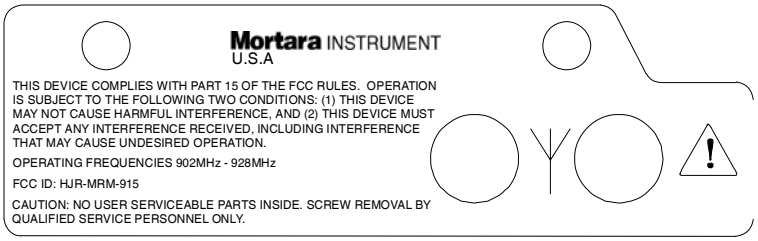
-10 Closing Plate with Modem Label - European


THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES.
OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS:
(1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND
(2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED,
INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED
OPERATION.
OPERATING FREQUENCIES 2400MHz - 2483MHz
Mortara INSTRUMENT
U.S.A
CAUTION: NO USER SERVICEABLE PARTS
INSIDE. SCREW REMOVAL BY QUALIFIED
SERVICE PERSONNEL ONLY.

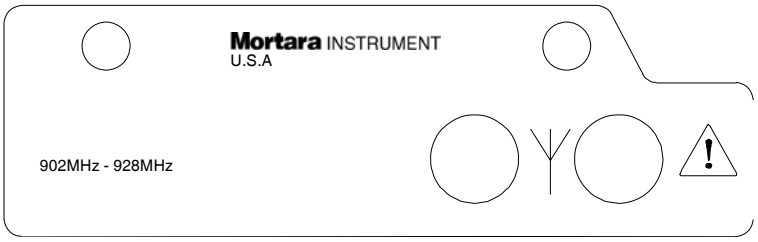
-11 MRM-2500 Label - Domestic



-12 MRM-2500 Label - European


Mortara INSTRUMENT
U.S.A
THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION
IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE
MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST
ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE
THAT MAY CAUSE UNDESIRED OPERATION.
OPERATING FREQUENCIES 902MHz - 928MHz
FCC ID: HJR-MRM-915
CAUTION: NO USER SERVICEABLE PARTS INSIDE. SCREW REMOVAL BY
QUALIFIED SERVICE PERSONNEL ONLY.

-13 MRM-915 Label - Domestic



-14 MRM-915 Label - European

6 4” Writer Assembly

Parts List #3

QTY:	*DESCRIPTION: 22500-100-50*	*PART NUMBER:*	*ITEM:*
1	Printhead thermal 104mm kyocera - 4.09"	5450-002-01	1
2	Screw shoulder hex M3 x 0.5 Stainless	6001-002-01	2
2	Screw Phillips Fillister M2 x 5	6020-120	3
3	Screw Phillips Flat M3 x 6	6020-730	4
2	Screw Sems M3 x 10mm W/2 Captive Washers	6024-005	5
4	Screw M3 x 6 W/2 Captive Lock Washer	6024-003	6
2	Set Screw Socket M2.5 x 4	6030-025	7
2	Washer Lock Split M2	6105-020	8
1	Washer Flat-Nylon .437" OD x .195" ID	6106-002	9
2	Washer Flat M2	6106-020	10
2	Washer Flat M3	6106-030	11
1	Washer Flat m3 9mm OD	6106-130	12
2	Spacer .19 x .25 x .125	6125-004	13
5	Spacer .19 x .25 x .015	6125-006	14
10	E-Ring .125 Shaft SS	6140-001	15
1	E-Ring .187 Shaft SS	6140-003	16
4	Washer Rubber 3/8 OD 1/8 ID Adhesive	6300-003	17
1	Gear Assembly Plastic Metric 46 Tooth	6515-046-50	18
1	Gear Assembly Plastic Metric 64 Tooth	6515-064-50	19
2	Bearing Ball .1875 ID SS	6520-003	20
2	Bearing Ball .1875 ID Flange SS	6520-004	21
2	Bearing Mandrel Spacer Black	6521-004-01	22
1	Spring 2" Roll Stock	6525-001-01	23
2	Spring Extension .88 x .18 x .031	6525-004-01	24
1	Spring Torsion Left Hand Latch	6525-007-01	25
1	Motor Assembly	6545-001-01	26
1	Shaft Main Pivot	6550-006-01	27
3	Shaft Paper Align & Deflect	6550-007-01	28
1	Platen/Shaft 4.173 x .79	6570-417-01	29
2	Tape Teflon 1" skived	7400-002	30
1	Sound Dampener 0.75 x 4.00	7405-001-01	31
1	Brush Anti-static 4.43"	7480-443-01	32
2	Spring Pad 2" Roll	8481-002-01	33
1	Latch Assembly	8554-001-50	34
1	Shaft Assembly	8554-002-50	35
1	Bar Spring Assembly	8554-003-50	36
2	Cam	8554-004-01	37
1	Floating Cover	8554-005-50	38
1	Slider Plate	8554-006-01	39
1	Chassis	8554-007-50	40
1	Main Cover	8554-008-50	41
1	Paper Trough	8554-009-50	42
1	Cable Braided Copper	3162-001-51	46
2	EMI Gasket Self Term Low Closure F .14 x .5	12001-001-50	47
1	Label Date Code	9003-007-50	48

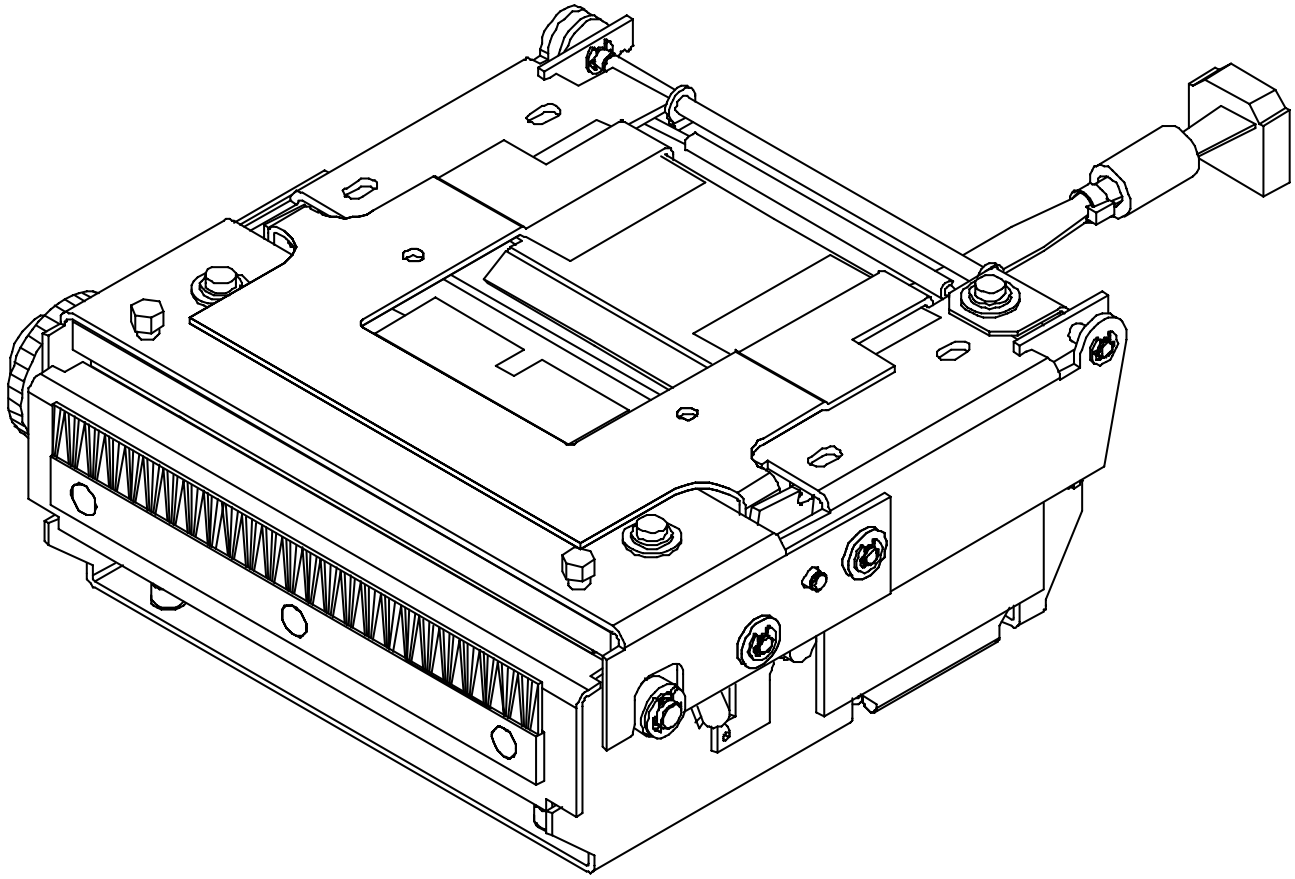


Figure 6-a Complete Writer Assembly

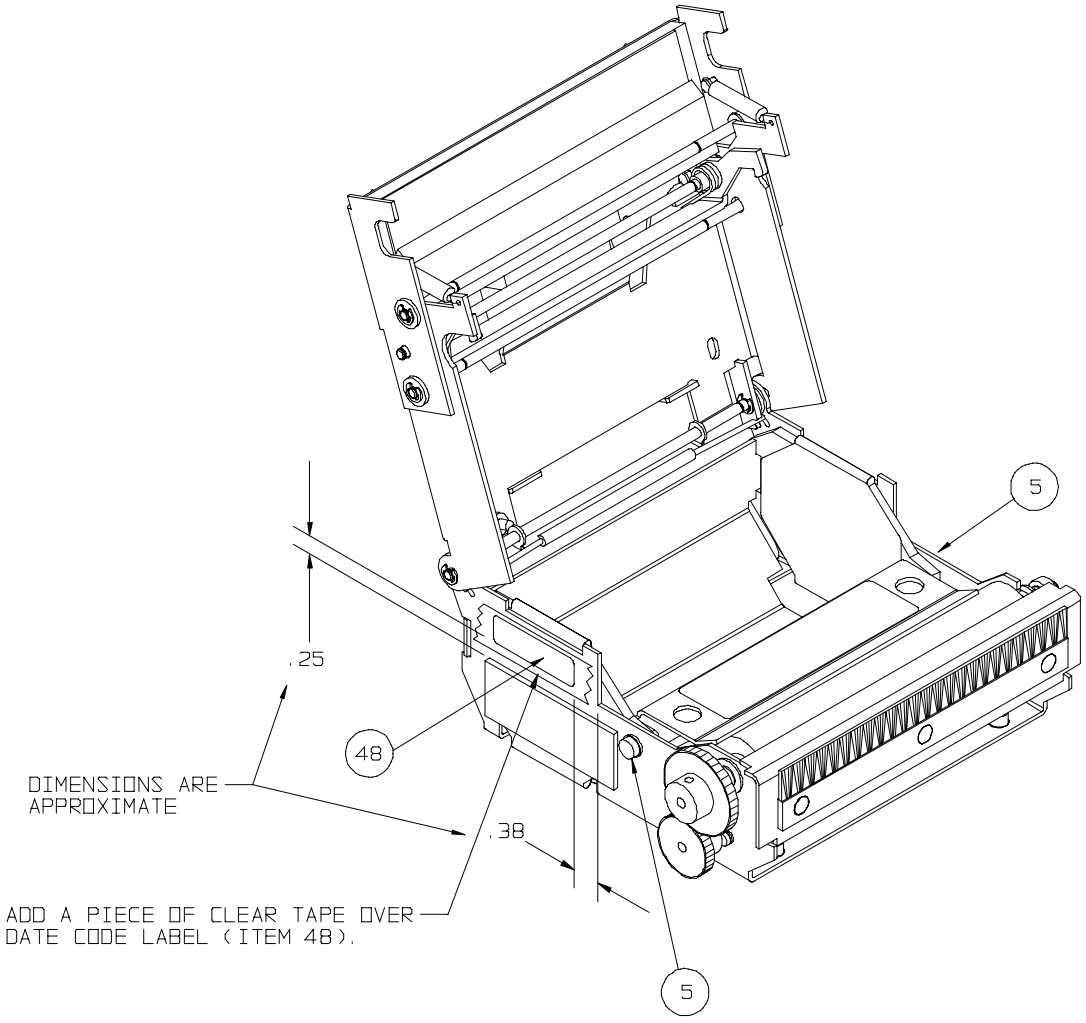


Figure 6-b Addition of Date Code Label And Bench Testing

Place the writer on assembly fixture Ref: 90000-014-50. Locate the writer on the assembly fixture with the four mounting holes in the writer over the four pins on the assembly fixture. Press down on the writer trough and the white spring pads and hold down.

Screws (Item5) for the writer trough must be tighened with a torgue tool. Required torque is 8±1 pound-inches.

Remove the writer from the fixture.

Place checking fixture Ref: 90000-014-51onto the writer. Locate the four [ins on the checking fixture into the four mounting holes in the writer. If fixture slides into the holes, the writer is in tolerance, if it does not; repeat steps above and recheck.

Attach Date Code Label (Item 48) as shown in figure above.

All writers must be bench tested for the motor ant the printhead function, using the test unit in the assembly area. Test writer per MIS-02-036-00, latest revision.

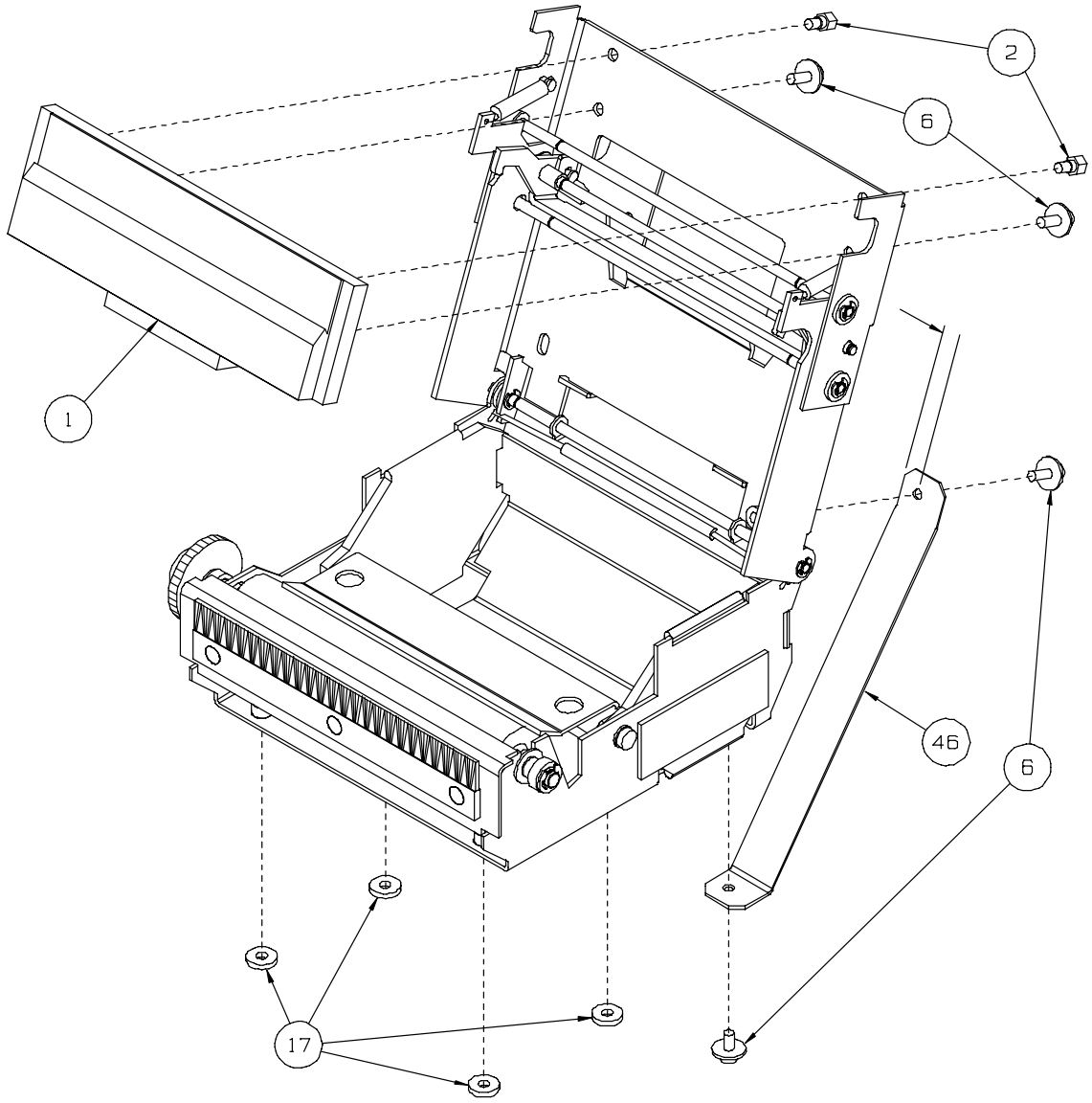


Figure 6-c Installing Printhead and Copper Braid Cable

Attach one end of the Braided Copper Cable (Item 46) to the top of the main cover and the other end to the bottom of the chassis using a Sems Screw (Item 6) at each end.

Caution: ***Writers with printheads installed will be treated as static sensitive according to MIS-01-001-00.***

Attach the Thermal Printhead (Item 1) to the Floating Cover using two Shoulder Screws (Item 2) and two Sems Screws (Item 6). See figure above for location of each set of two screws.

Affix four Rubber Washers (Item 17) to the bottom of the Chassis.

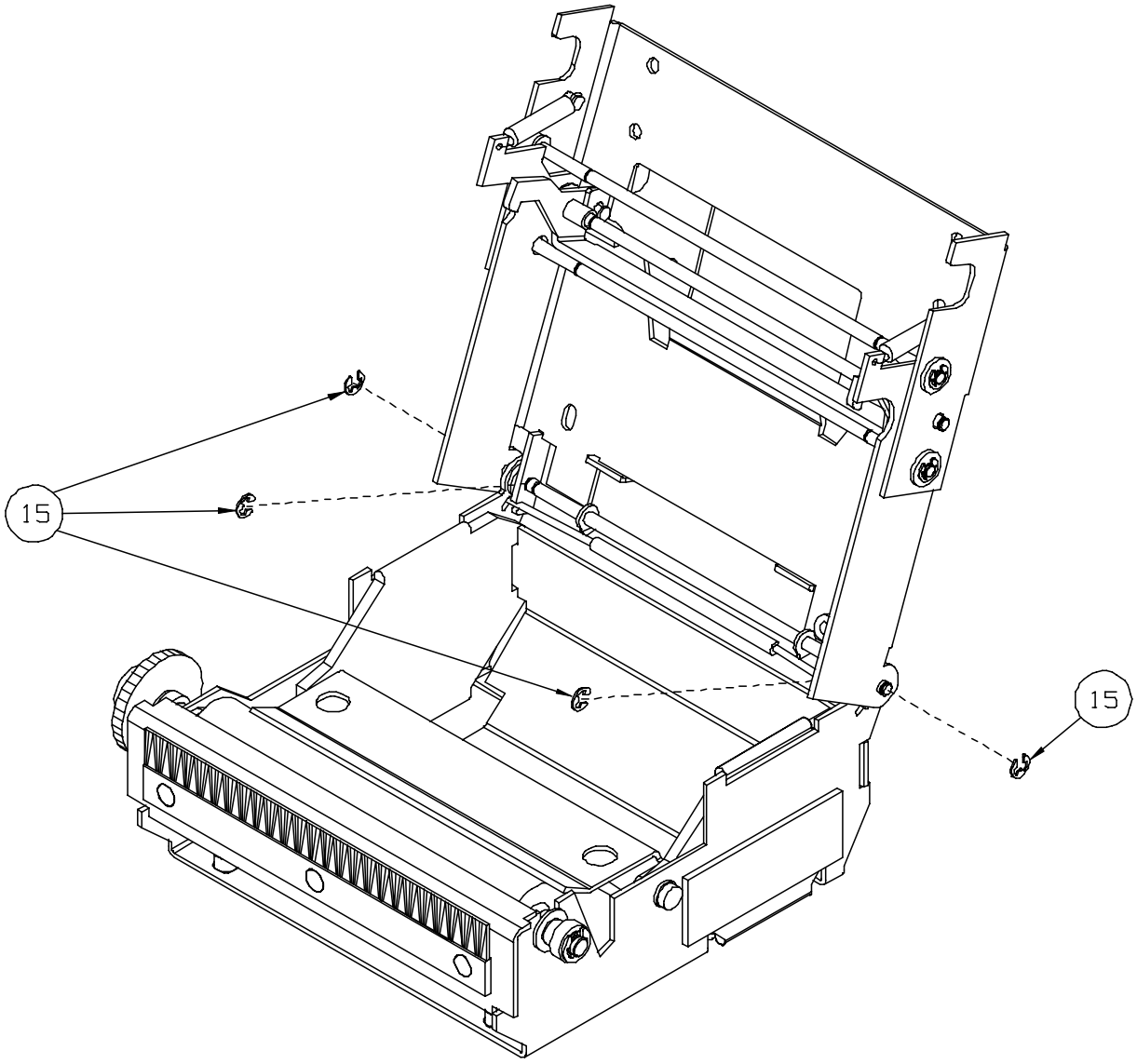


Figure 6-d Installing E-Rings to Cover

Retain the Cover Assembly with four E-Rings (Item 15). Place two E-Rings in the grooves nearest the inside surface of the Cams. Place two more E-Rings at the ends of the Main Pivot Shaft.

Check whether the Spring Functions correctly and does not contact the Main Cover when it is opened and closed.

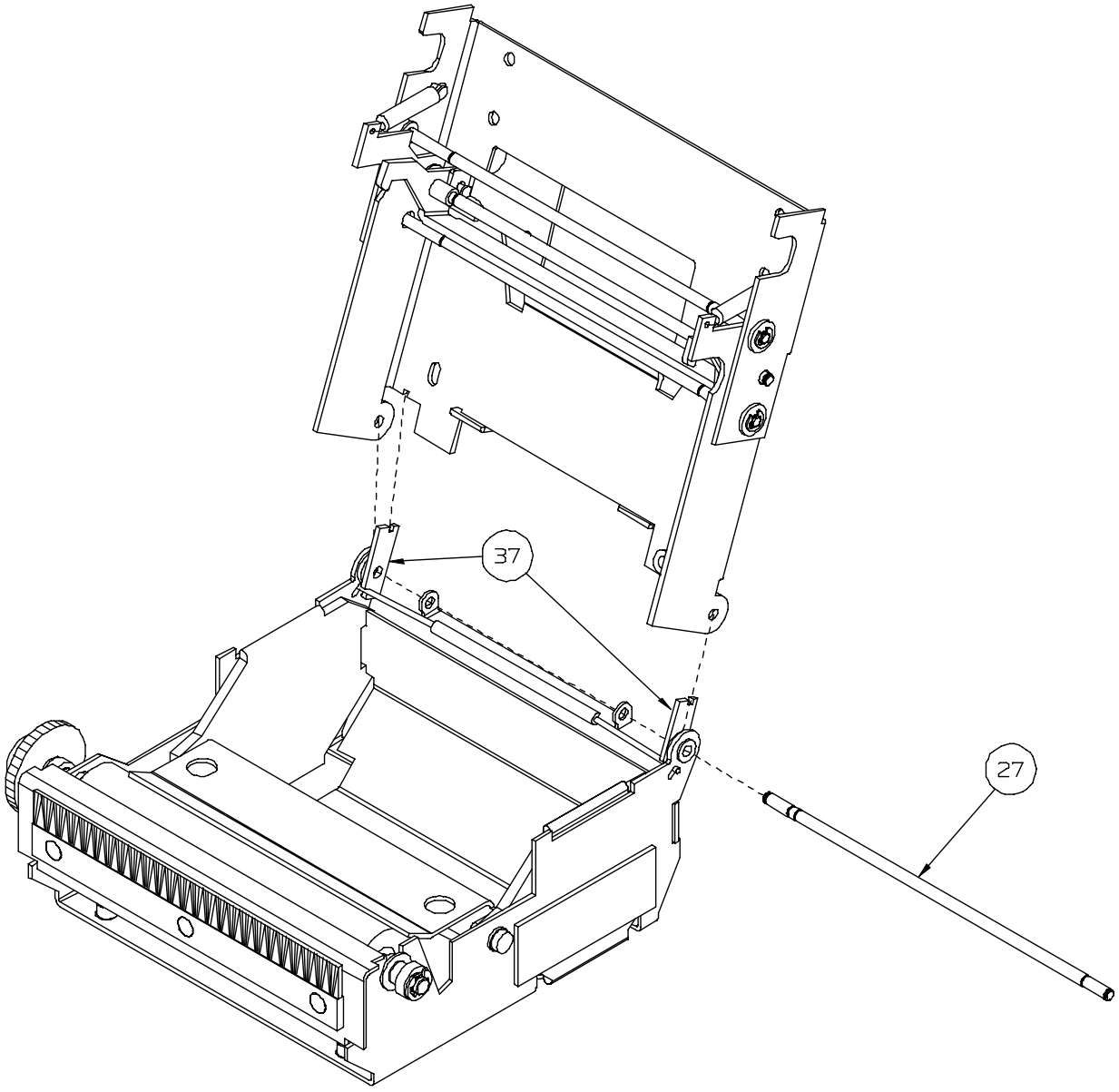


Figure 6-e Installing the Main Pivot Shaft

Hold the Main Pivot Shaft (Item 27) with the end with three grooves toward the motor side of the chassisassmebly. Slide the Main Pivot Shaft through the pivot hole in the main cover assembly. Through the pivot hole in the main chassis, through a Cam (Item 37) with its notch placed in a matching notch in the main cover, and though both ears of the spring bar. Then insert it through another Cam (Item 37) with its notch in the matching notch on the main cover, out through the chassis pivot hole, and through the pivot hole in the cover assembly.

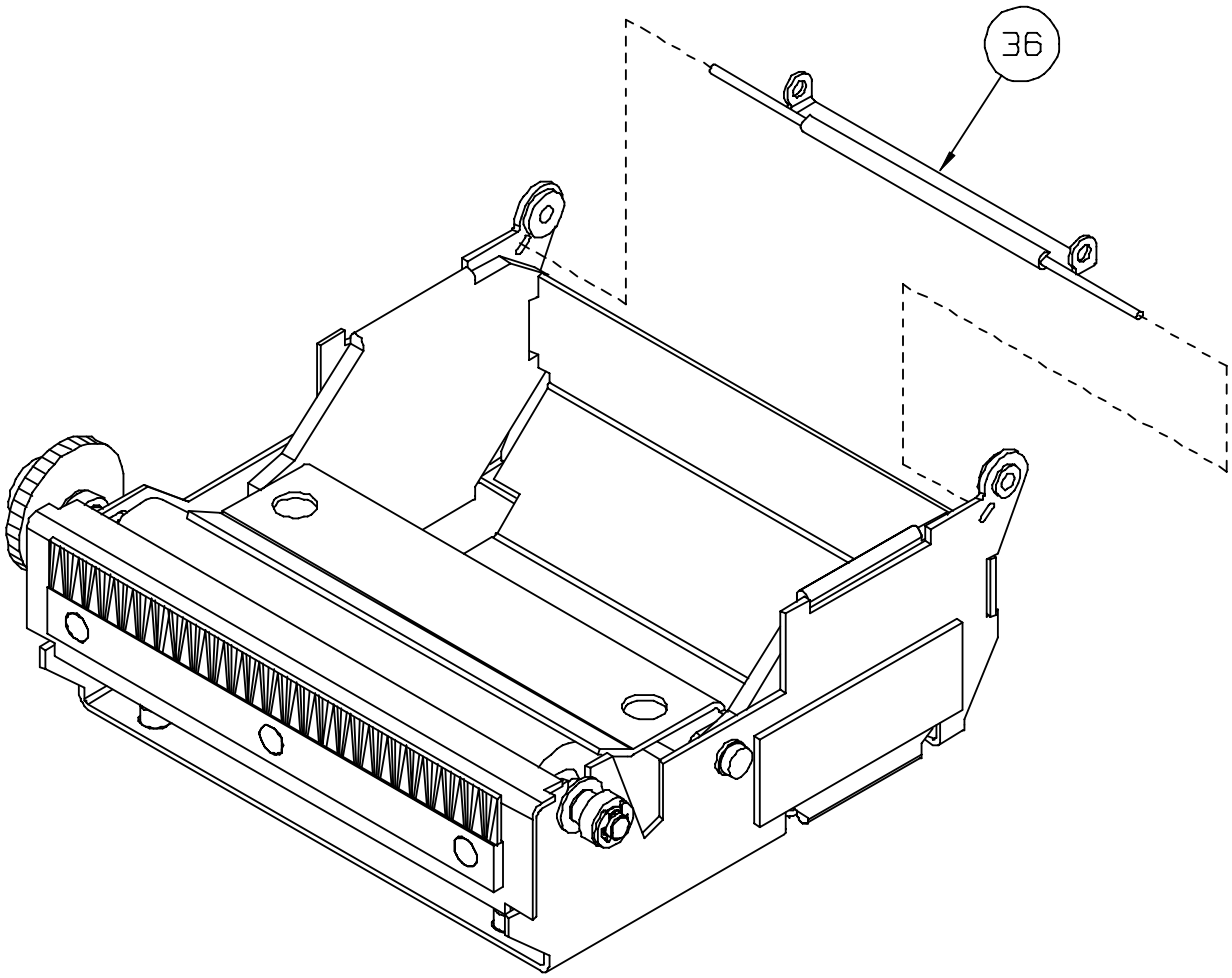


Figure 6-f Installation of Spring Bar.

Insert the Spring Bar (Item 36) from the inside of the chassis into slots near the pivot end of the chassis assembly.

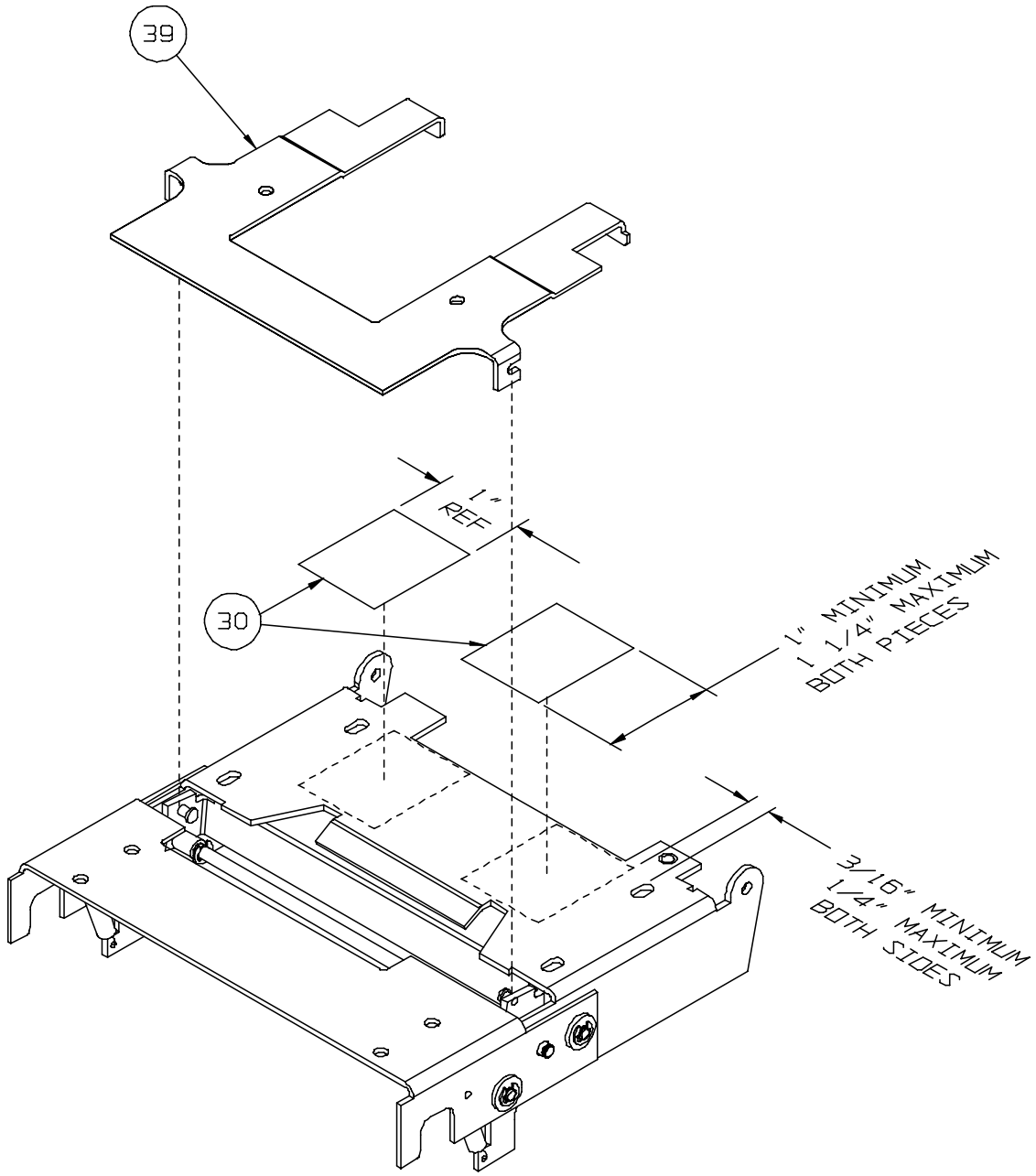


Figure 6-g Installing Slider Plate

Turn the cover assembly over. Attach the Anti-friction Teflon Tape (Item 30) to the main cover as shown above.

Tape must be kept 3/16" away from the slotted holes.

Place the hooks on the Alider Plate (Item 39) over the rear edge of the main cover and then snap it down over the latch posts.

Make sure the latch and floating cover function freely with no binding.

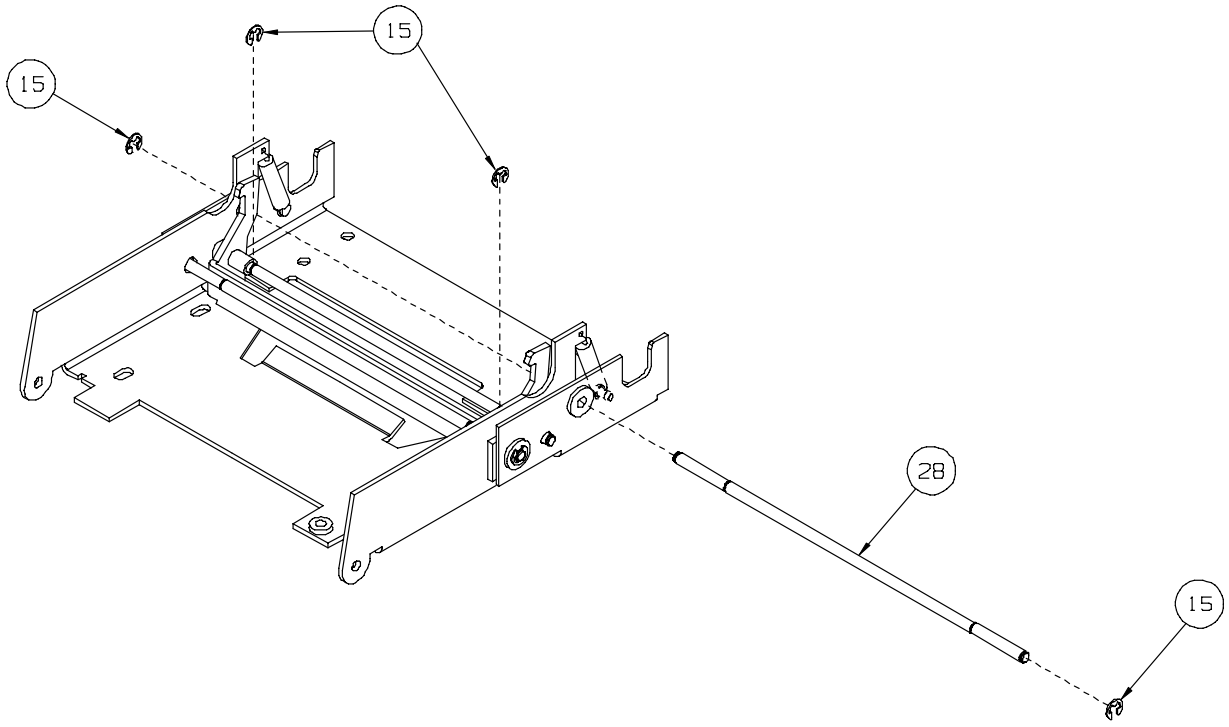


Figure 6-h Installing Alignment Deflector Shaft

Retain the float cover to the main cover asssembly with two E-Rings (Item 15) pressed onto the inside grooves of the shaft.
Hook the other end of the springs attached to the main cover onto the posts on the float cover.
Slide another Alignment/Deflector Shaft (Item 28) trough the other plastic bearings in both sides of the float cover. Retain it with two E-Rings (Item 15) inserted into the grooves near the ends of the shaft.

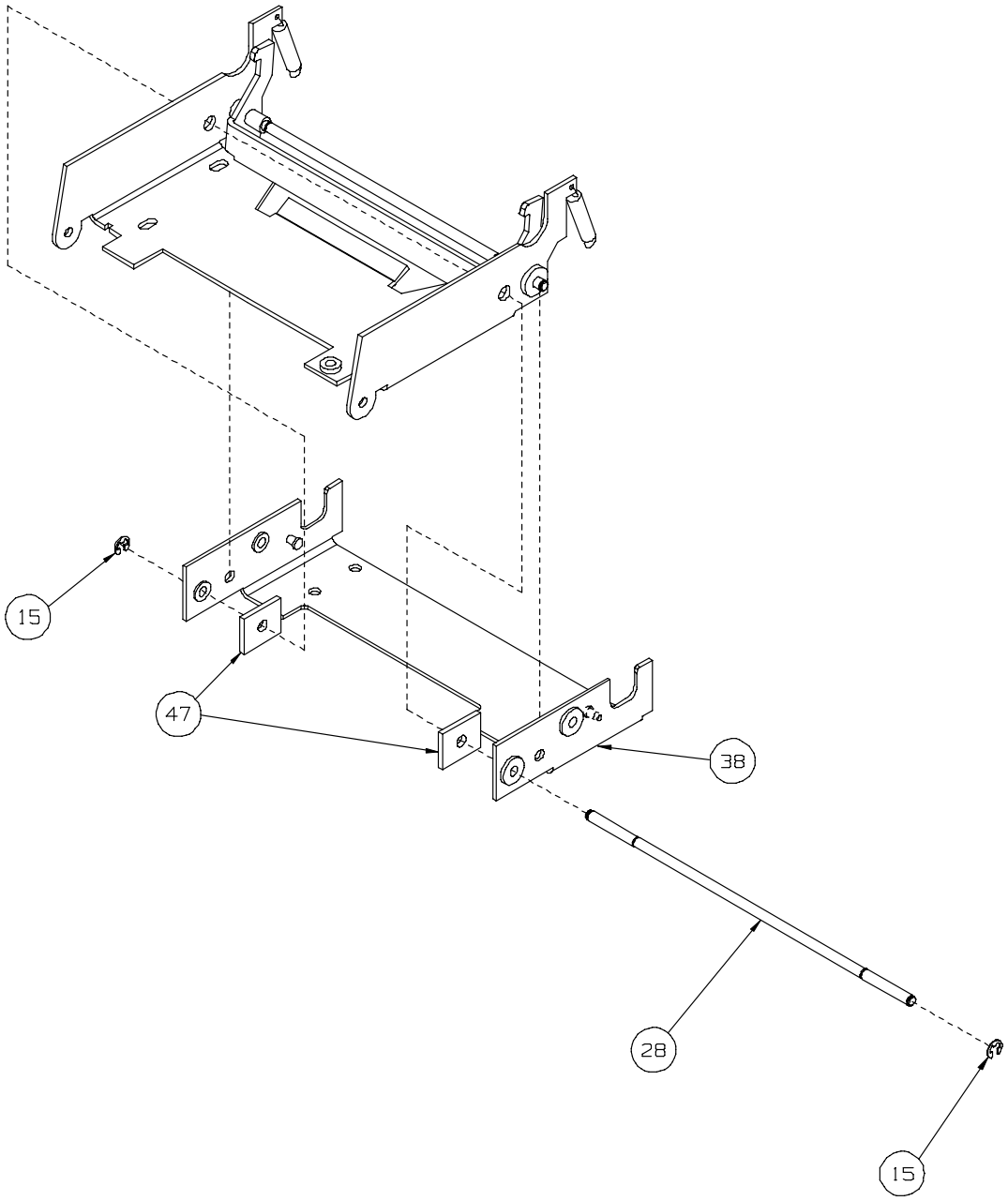


Figure 6-i Installing Floating Cover and Grounding Gaskets

With the Floating Cover (Item 38) upside down, place the holes without the bearings over the ends of the shaft in the main cover assembly. The shaft may have to be moved from side to side to allow the float cover to go on.

Position the Grounding Gaskets (Item 47) between the main cover and the floating cover flanges with their holes aligned with holes in the floating cover and the main cover. Pass an alignment/Deflector Shaft (Item 28) through the plastic bearings in the floating cover, through the hole in the grounding gaskets, and through the matching holes in the main cover. Retain the shaft with two E-Rings (Item 15) inserted into the grooves on the end of the shaft.

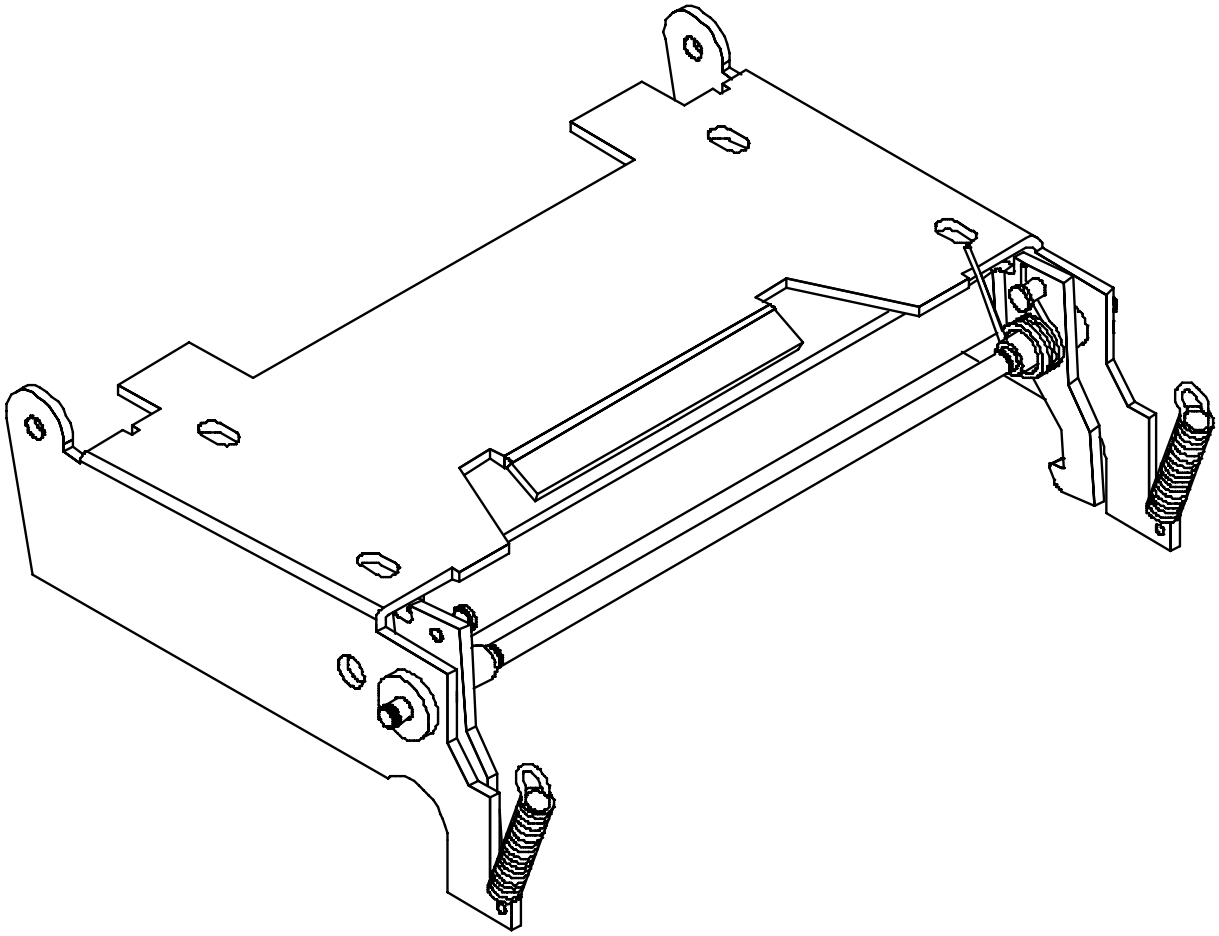


Figure 6-j Detail of Spring

Set the torsion spring as shown in view above, making sure that the spring is against head of post in latch bar.

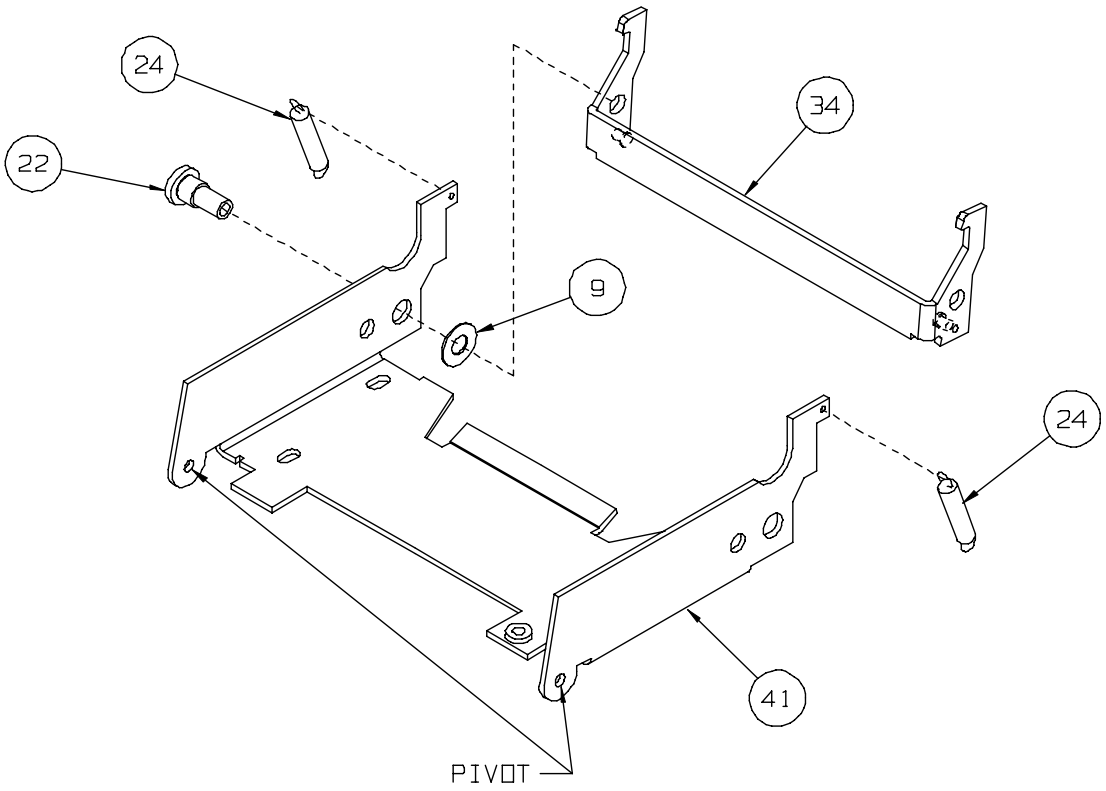


Figure 6-k Installing Latch and Springs

Place the Main Cover (Item 41) upside down on the bench with the pivot side near you.
Attach two Extension Springs (Item 24) to main cover as shown.
On the left side, insert a Mandrel Spacer Bearing (Item 22) with its flange to the outside, into the mating hole near the rear of the main cover.
Over the mandrel spacer and inside of the main cover, place the Plastic Washer (Item 9).
Place the Latch (Item 34), with its hooks facing toward the pivot side, inside of the main cover, over the mandrel spacer bearing, and against the plastic washer.

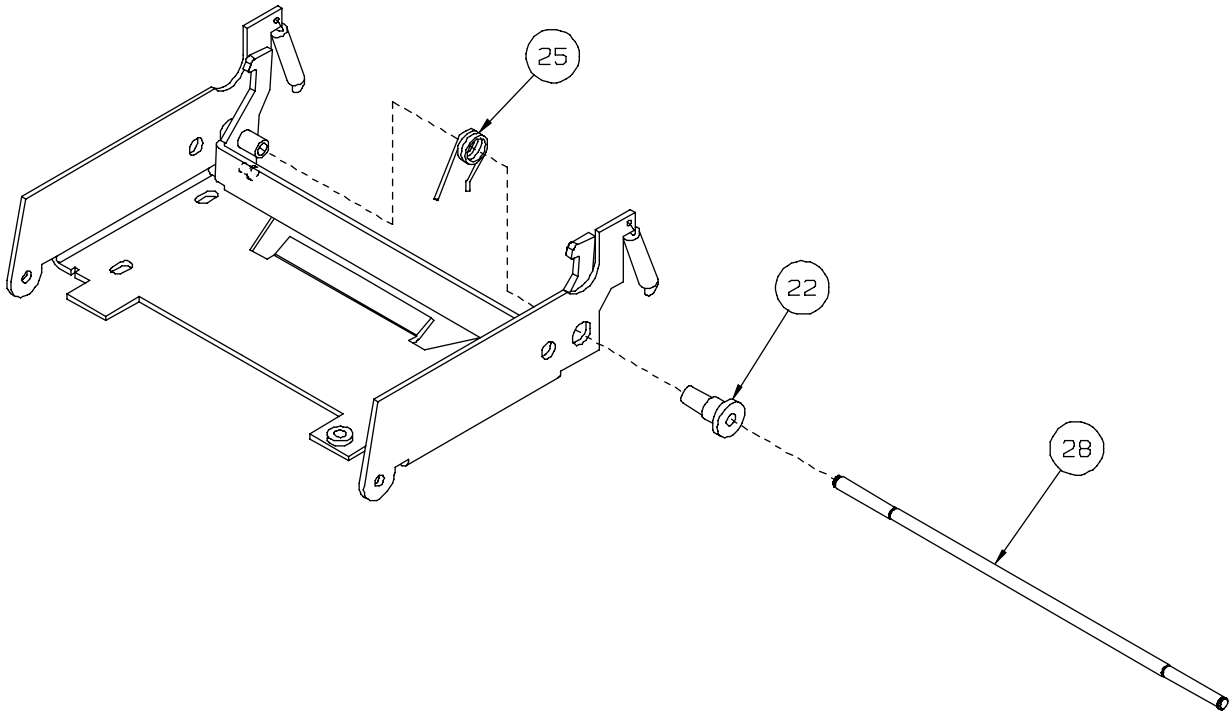


Figure 6-I Installing Slide Shaft, Bearing and Spring

Insert another Mandrel Spacer Bearing (Item 22), with its flange to the outside, through the hole on the side opposite the other mandrel spacer bearing.
Place the Torsion Spring (Item 25) inside of the main cover and over the mandrel spacer bearing with its ends oriented as shown.
Slide Shaft (Item 28) through the entire assembly.

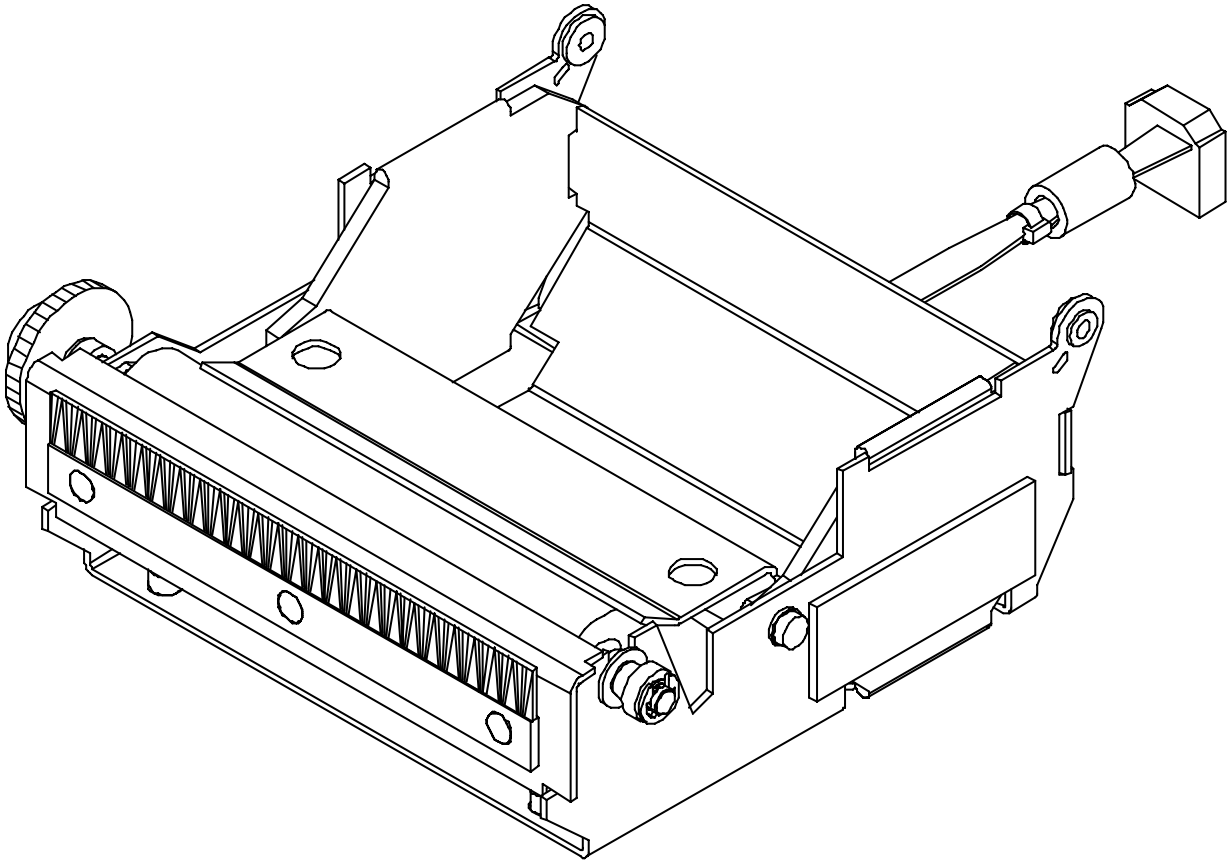


Figure 6-m Lower Chassis Complete

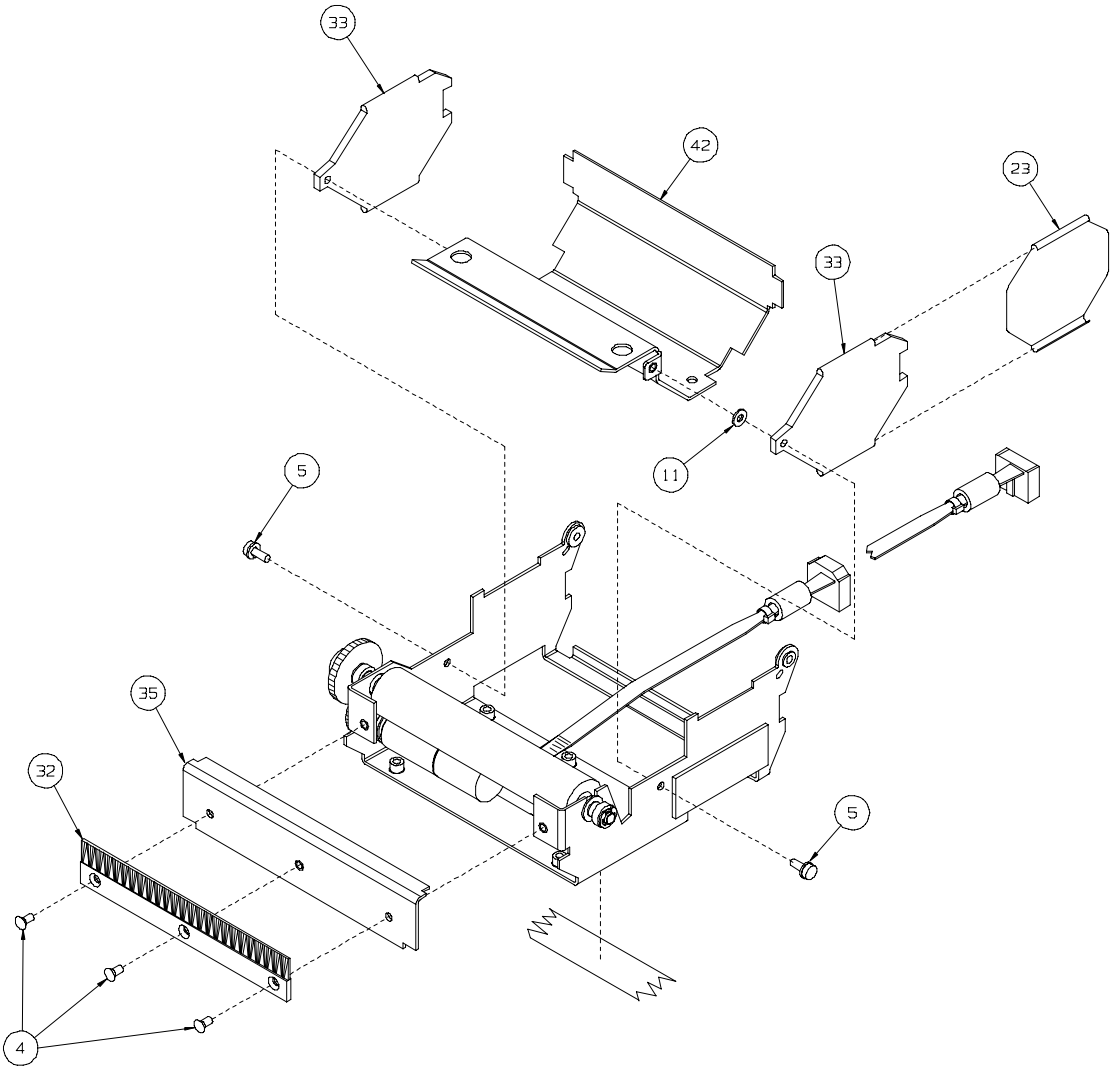


Figure 6-n Completion of Lower Chassis

Orient the Shelf (Item 35) with its flange toward the platen. Place the Brush (Item 32), with its bristles up, on the front of the shelf and fasten them together with a Flathead Screw (Item 4) inserted into the center hole in the brush. Then fasten both to the front of the chassis with two more Flathead Screws (Item 4).

Lay the motor cable out the back of the chassis. Be sure that it is laying flat and will not kink when the paper trough is placed on top of it. Check the motor connector position. The connector must face down. Place the Paper Trough (Item 42) into the rear of the chassis with its mounting ears toward the platen. Slide the Spring (Item 23) onto the Spring Pad (Item 33) on the side away from the gears and place it between the chassis and the paper trough. Place the other Spring Pad (Item 33) between the paper trough and the chassis on the side toward the gears. Place a washer (Item 11) between the paper trough and the spring pad on the side away from the gears. Secure these parts with 2 screws with 2 Captive Washers (Item 5), one inserted into each side.

⚠ ***Leave screws loose until final assembly test is done as described by Fig 6-b.***

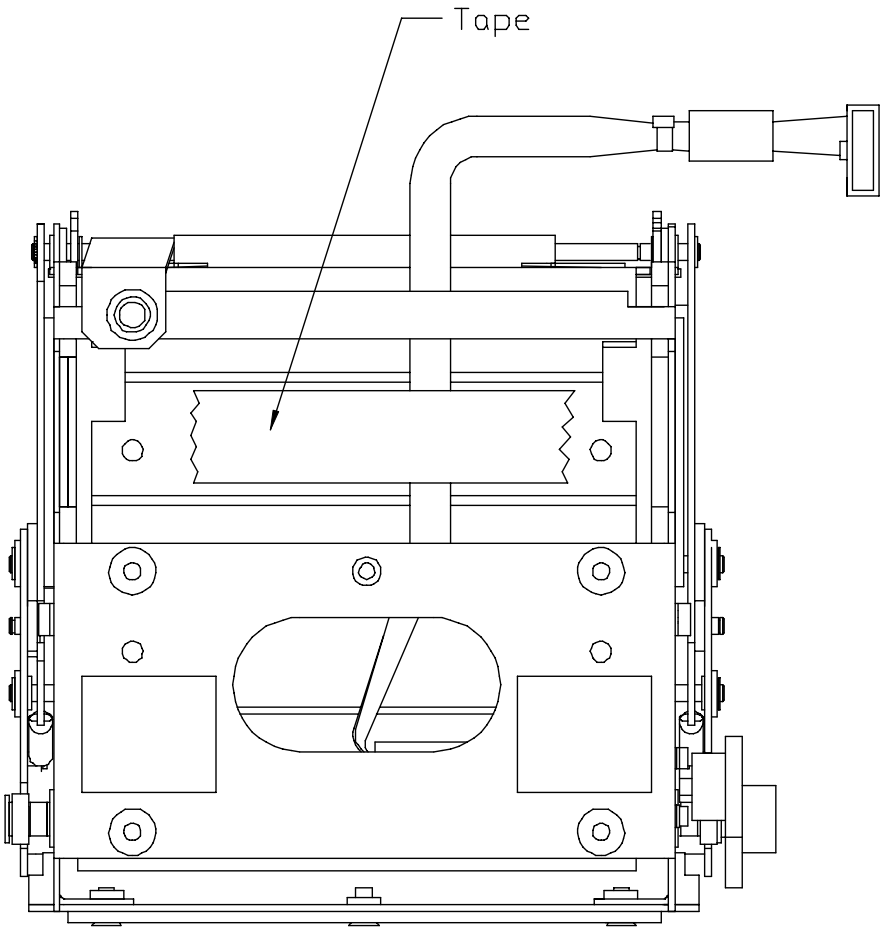


Figure 6-o View of Bottom of Paper Trough

Tape motor cable to the bottom of the paper trough with a piece of strapping tape approximately 2" long.

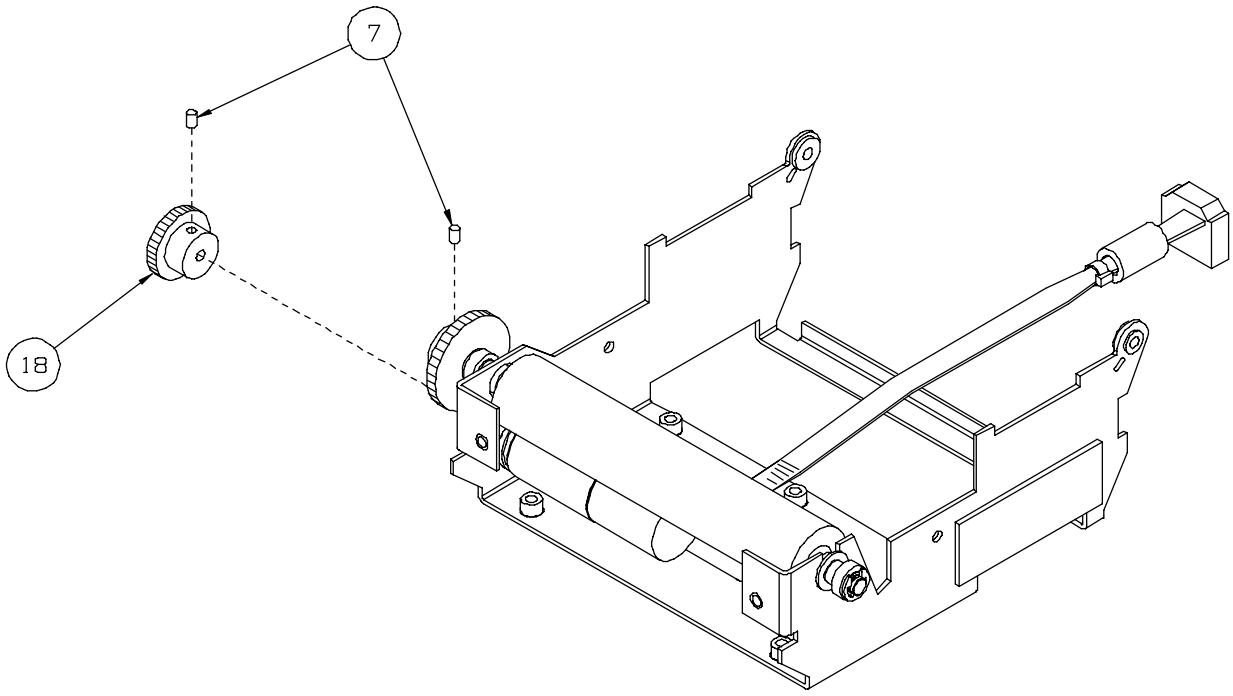


Figure 6-p Installation of 48 Tooth Gear

Install the 46 Tooth Gear (Item 18) on the motor with the hub towards the motor. Gear teeth must be akigned with the large gear for maximum engagment. Secure in place using a Set Screw (Item 7). The set screw must engage the flat portion of the motor shaft.

Set screws for the gear must be tightened with a torque tool. Required torgue is 4±1 pound-inches.

Make sure the gear does not drag on motor retaining screws.

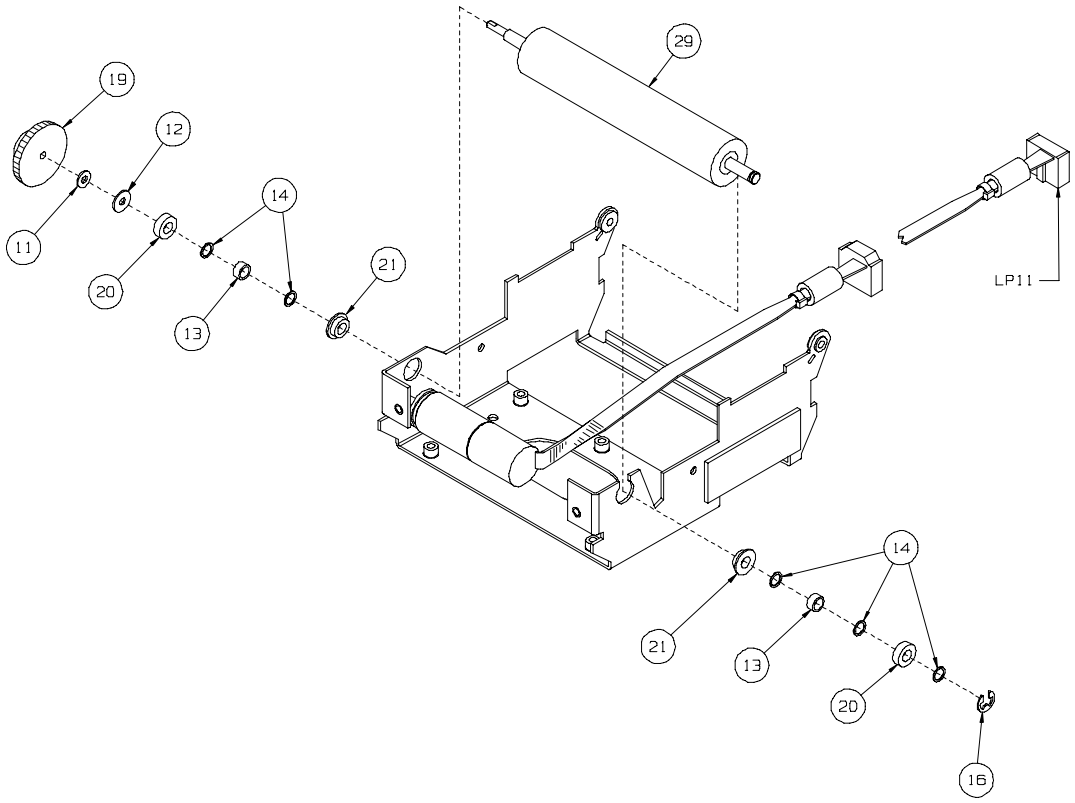


Figure 6-q Installation of Platen and Gears

Place the Platen (Item 29) in the chassis with the longest end of the shaft on the side with the motor. Next, place the flanged Bearing (Item 21) on the side of the platen away from the motor with the flange to outside of the chassis. Then install the following:

- Spacer .015 Thick (item 14)
- Spacer .125 Thick (Item 15)
- Spacer .015 Thick (item 14)
- Unflanged Bearing (Item 20)
- Spacer .015 Thick (item 14)
- E-Ring for .187 Shaft (Item 16)

Next, mount one Flanged Bearing (Item 21) on the motor side of the platen with the flamge to the outside of the chassis. Then install the following:

- Spacer .015 Thick (item 14)
- Spacer .125 Thick (Item 15)
- Spacer .015 Thick (item 14)
- Unflanged Bearing (Item 20)
- Washer 3mm x 9mm OD (Item 12)
- Washer 3mm Flat (Item 11)
- Gear 64 Tooth (Item 19)

Use a Set Screw (Item 7) to install the Gear (Item 19) with the hub away from the chassis.

Set Screws for the gear must be tightened with a torgue tool. Required torque is 4±1 pound-inches. The gear should be all the way down on the platen and the set screw should engage the flat portion of the platen. If needed, install extra spacers (Item 14) to tafe up any side to side movement of the platen.

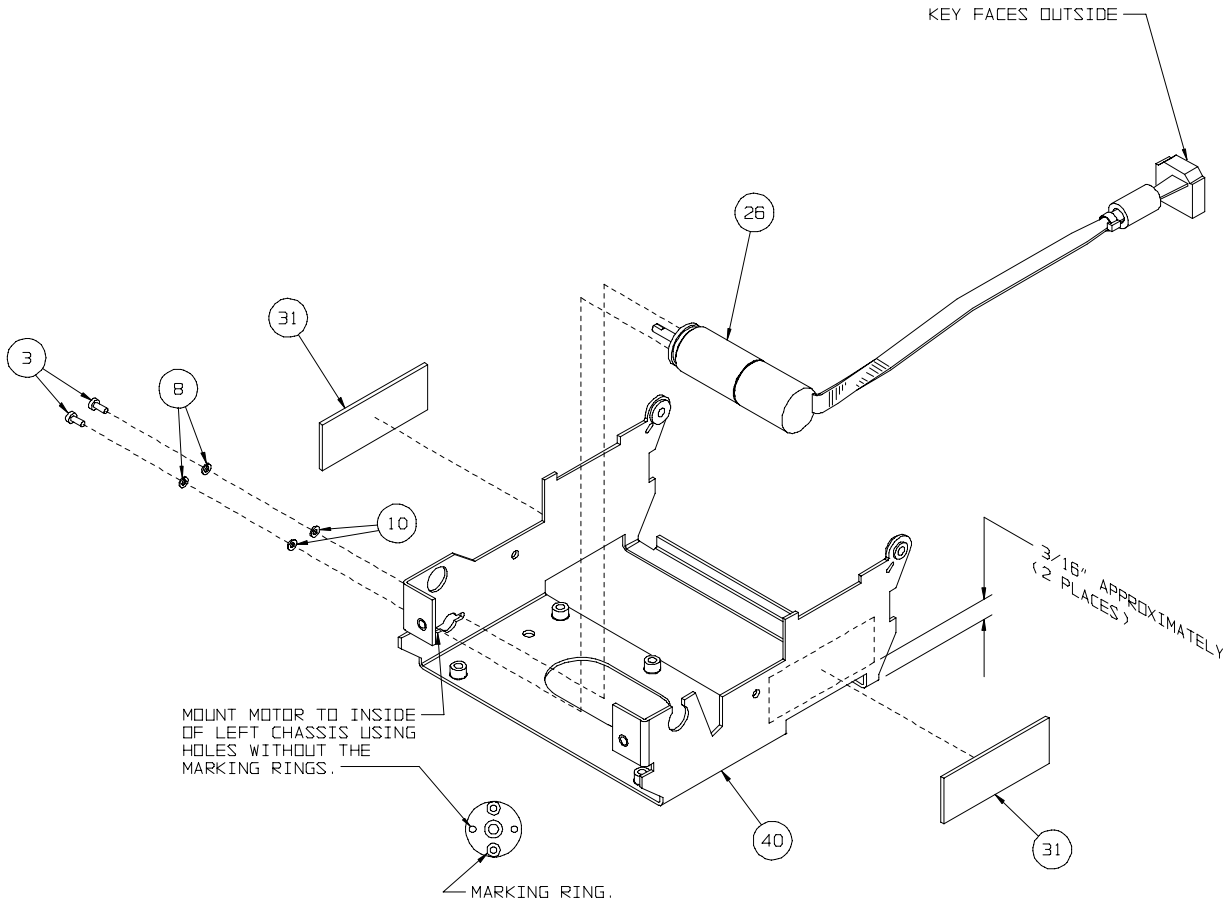


Figure 6-r Installation of Motor and Sound Dampeners

Cut the 4" strip of Sound Dampener (Item 31) in half. Peel the backing from both pieces and attach to theChassis (Item 40).
Before installing the motor, be sure the motor connector conforms to the notes in view above.
Install the motor (Item 26) to the chassis with 2 Screws (Item 3), 2 Lockwashers (Item 8), and 2 Flat Washers (Item 10).

Screws (Item 3) for the motor must be tightened with a torgue tool. Required torque is 44±4 pound-inches.

Lay the motor cable out the rear of the chassis.

7 Printed Circuit Boards

Introduction

This section provides illustrations and the schematics for the ELI 100 Printed Circuit boards. The parts lists have not been provided, as the boards are to be ordered for replacement as a whole, not they're individual components

Anti-Static equipment should always be worn when working with static sensitive devices and in a static sensitive area.

Motherboard Ref: 26025-002-50

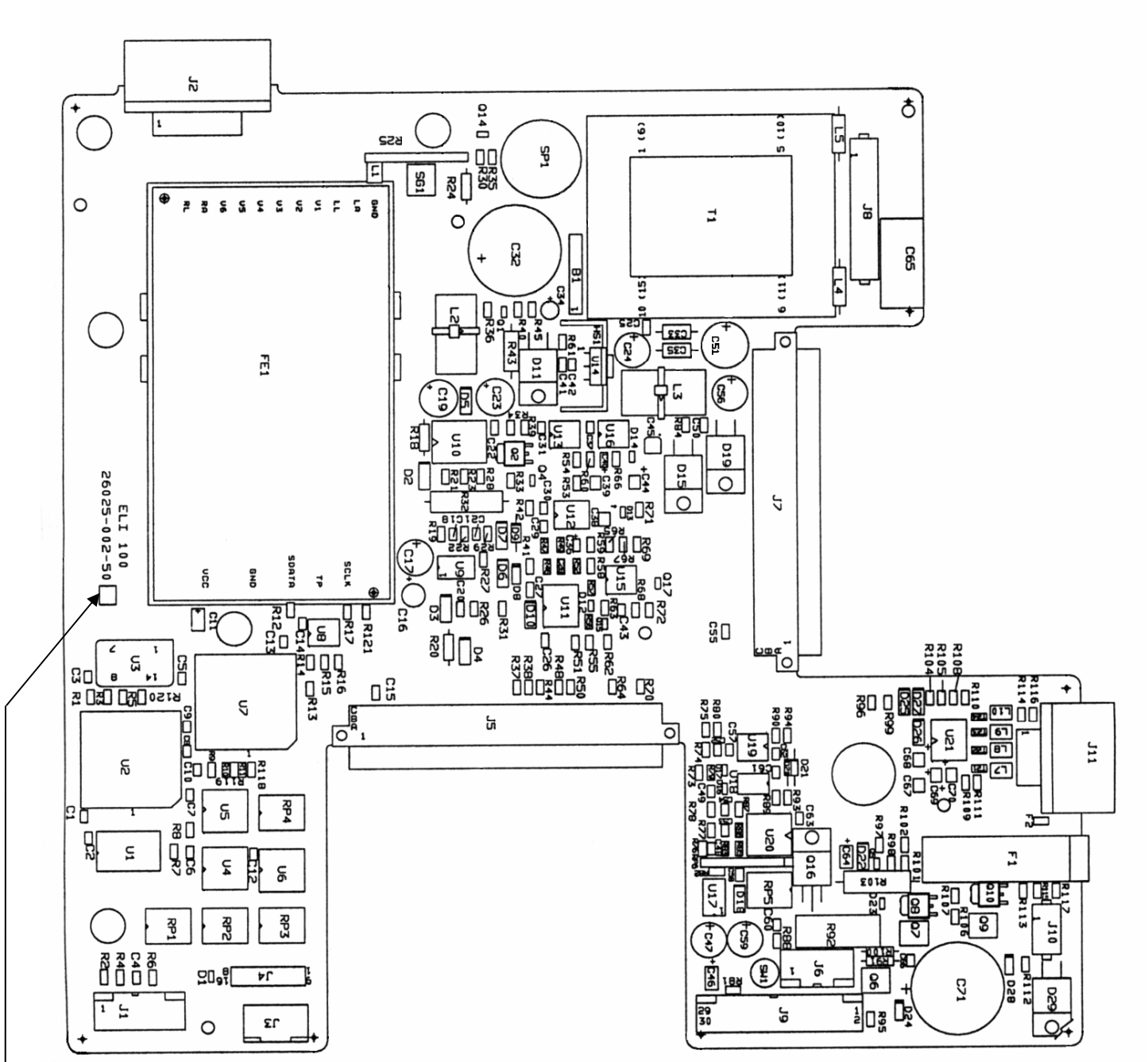
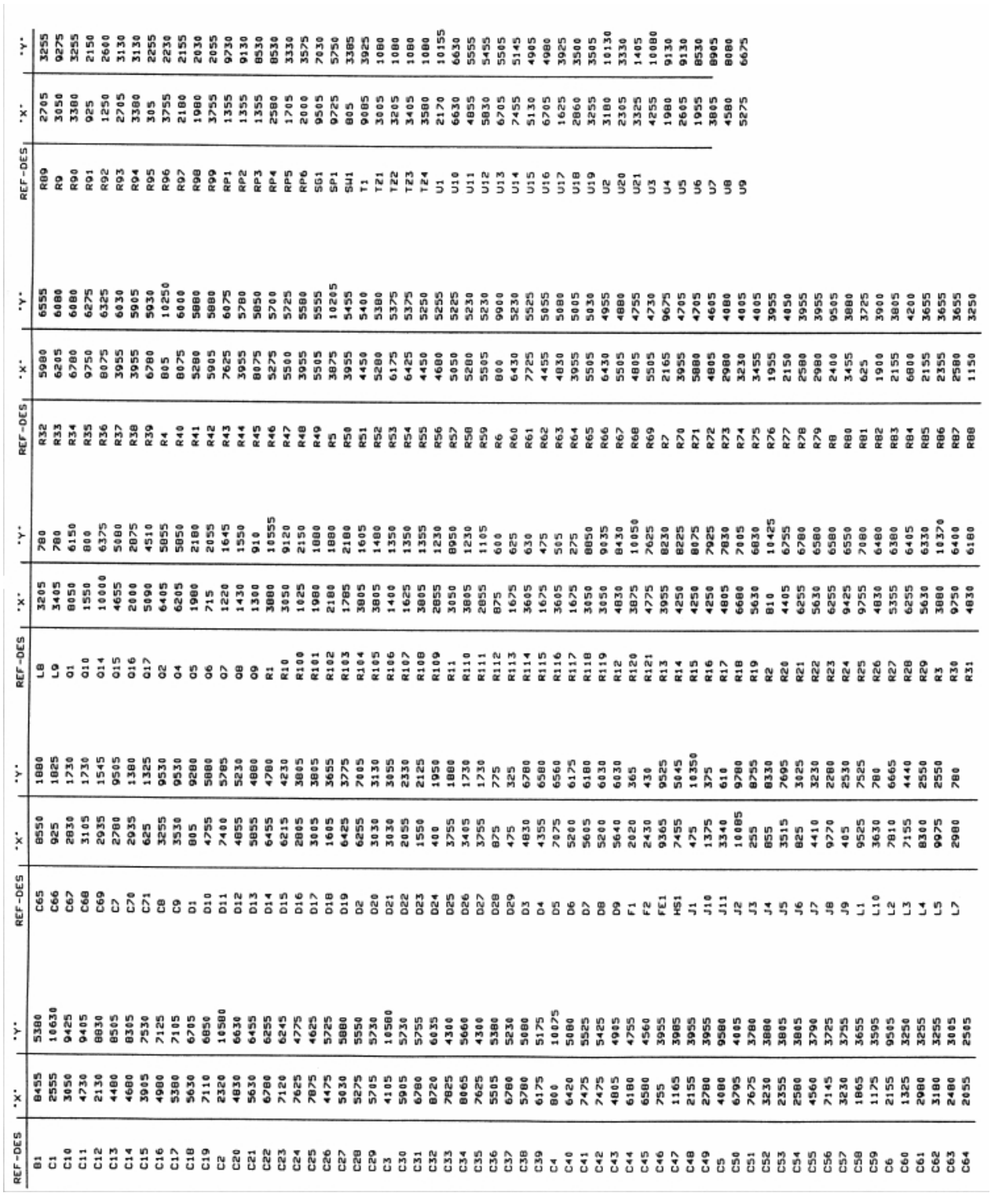


Figure 7-a Motherboard

Current configuration revision letter of the printed circuit board will be permanently marked in this area.

See assembly notes and details on the following pages.



REF-DES	'X'	'Y'	REF-DES	'X'	'Y'	REF-DES	'X'	'Y'	REF-DES	'X'	'Y'	REF-DES	'X'	'Y'
B1	8455	5380	C65	8550	1080	L8	3205	780	R32	5900	6555	R89	2705	3255
C1	2555	10630	C66	925	1025	L9	3405	780	R33	6205	6080	R9	3050	9275
C10	3050	9425	C67	2830	1730	Q1	8050	6150	R34	6780	6080	R90	3300	3255
C11	4730	9405	C68	3105	1730	Q10	1550	800	R35	9750	6275	R91	925	2150
C12	2130	8830	C69	2935	1545	Q14	10000	6375	R36	8075	6325	R92	1250	2600
C13	4480	8505	C7	2780	9505	Q15	4655	5080	R37	3955	6030	R93	2705	3130
C14	4680	8305	C70	2935	1380	Q16	2000	2075	R38	3955	5905	R94	3380	3130
C15	3905	7530	C71	625	1325	Q17	5090	4510	R39	6780	5930	R95	305	2255
C16	4900	7125	C8	3255	9530	Q2	6405	5055	R4	805	10250	R96	3755	2230
C17	5380	7105	C9	3530	9530	Q4	6205	5050	R40	8075	6000	R97	2180	2155
C18	5630	6705	D1	805	9280	Q5	1900	2180	R41	5280	5880	R98	1980	2030
C19	7110	6850	D10	4755	5880	Q6	715	2055	R42	5905	5880	R99	3755	2055
C2	2320	10580	D11	7400	5705	Q7	1220	1645	R43	7625	6075	RP1	1355	9730
C20	4830	6630	D12	4855	5230	Q8	1430	1550	R44	3955	5780	RP2	1355	9130
C21	5630	6455	D13	5855	4880	Q9	1300	910	R45	8075	5850	RP3	1355	8530
C22	6780	6255	D14	6455	4700	R1	3080	10555	R46	5275	5700	RP4	2580	8530
C23	7120	6245	D15	6215	4230	R10	3050	9120	R47	5560	5725	RP5	1705	3330
C24	7625	4775	D16	2805	3805	R100	1625	2150	R48	3955	5580	RP6	2000	3525
C25	7075	4625	D17	3005	3805	R101	1980	1080	R49	5505	5555	SG1	9505	7030
C26	4475	5725	D18	1605	3655	R102	2180	1080	R5	3875	10205	SP1	9725	5750
C27	5030	5880	D19	6425	3775	R103	1705	2180	R50	3955	5455	SW1	805	3385
C28	5275	5550	D2	6255	7005	R104	3805	1605	R51	4450	5400	T1	9005	3925
C29	5705	5230	D20	3030	3130	R105	3805	1480	R52	5280	5380	T21	3005	1080
C3	4105	10580	D21	3030	3055	R106	1400	1350	R53	6175	5375	T22	3205	1080
C30	5905	5230	D22	2055	2330	R107	1625	1350	R54	6425	5375	T23	3405	1080
C31	6780	5755	D23	1550	2125	R108	3805	1355	R55	4450	5250	T24	3580	1080
C32	8720	6035	D24	400	1950	R109	2855	1230	R56	4680	5255	U1	2170	10155
C33	7825	4300	D25	3755	1880	R11	3050	8950	R57	5050	5225	U10	6630	6630
C34	8065	5660	D26	3405	1730	R110	3805	1230	R58	5280	5230	U11	4855	5555
C35	7625	4300	D27	3755	1730	R111	2855	1105	R59	5505	5230	U12	5030	5455
C36	5505	5380	D28	875	775	R112	875	600	R6	800	9900	U13	6705	5505
C37	6780	5230	D29	475	325	R113	1675	625	R60	6430	5230	U14	7455	5145
C38	5780	5080	D3	4830	6780	R114	3605	630	R61	7725	5525	U15	5130	4905
C39	6175	5175	D4	4355	6580	R115	1675	475	R62	4455	5055	U16	6705	4980
C4	800	10075	D5	7075	6560	R116	3605	505	R63	4830	5080	U17	1625	3925
C40	6420	5080	D6	5200	6175	R117	1675	275	R64	3955	5005	U18	2860	3500
C41	7475	5525	D7	5605	6180	R118	3050	8050	R65	5505	5030	U19	3255	3505
C42	7475	5425	D8	5200	6030	R119	3050	9035	R66	6430	4955	U2	3180	10130
C43	4805	4905	D9	5640	6030	R12	4830	8430	R67	5505	4880	U20	2305	3330
C44	6180	4755	F1	2020	365	R120	3825	10050	R68	4805	4755	U21	3325	1405
C45	6580	4560	F2	2430	430	R121	4725	7625	R69	5505	4730	U3	4255	10080
C46	755	3955	FE1	9305	9525	R13	3955	8230	R7	2165	9675	U4	1980	9130
C47	1165	3905	HS1	7455	5645	R14	4250	8225	R70	3955	4705	U5	2605	9130
C48	2155	3955	J1	475	10350	R15	4250	8075	R71	5880	4705	U6	1955	8530
C49	2780	3955	J10	1375	375	R16	4250	7925	R72	4805	4605	U7	3805	8905
C5	4080	9580	J11	3340	610	R17	4805	7830	R73	2980	4080	U8	4580	8080
C50	6705	4005	J2	10005	9780	R18	6680	7005	R74	3230	4005	U9	5275	6675
C51	7675	3780	J3	255	8755	R19	5630	6830	R75	3455	4005			
C52	3230	3880	J4	855	8330	R2	810	10425	R76	1955	3955			
C53	2355	3805	J5	3515	7605	R20	4405	6755	R77	2150	4050			
C54	2580	3805	J6	825	3025	R21	6255	6780	R78	2580	3955			
C55	4560	3790	J7	4410	3230	R22	5630	6580	R79	2980	3955			
C56	7145	3725	J8	9270	2280	R23	6255	6580	R8	2405	9505			
C57	3230	3755	J9	405	2530	R24	9425	6550	R80	3455	3880			
C58	1865	3655	L1	9525	7525	R25	9755	7080	R81	625	3725			
C59	1175	3595	L10	3630	780	R26	4830	6480	R82	1900	3900			
C6	2155	9505	L2	7810	6665	R27	5355	6380	R83	2155	3805			
C60	1325	3250	L3	7155	4440	R28	6255	6405	R84	6800	4200			
C61	2980	3255	L4	8300	2550	R29	5630	6330	R85	2155	3655			
C62	3180	3255	L5	9975	2550	R3	3080	10370	R86	2355	3655			
C63	2480	3005	L7	2980	780	R30	9750	6400	R87	2580	3655			
C64	2655	2505				R31	4830	6180	R88	1150	3250			

Figure 7-b Motherboard 'X'-'Y' Coordinates

Dimensions are in mils, 1.e; 2750 = 2.750, these are to the center of each component or devices.

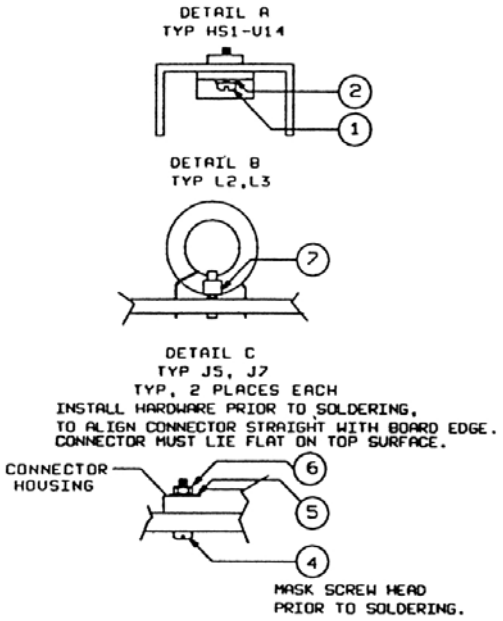


Figure 7-c Installation Details for Motherboard

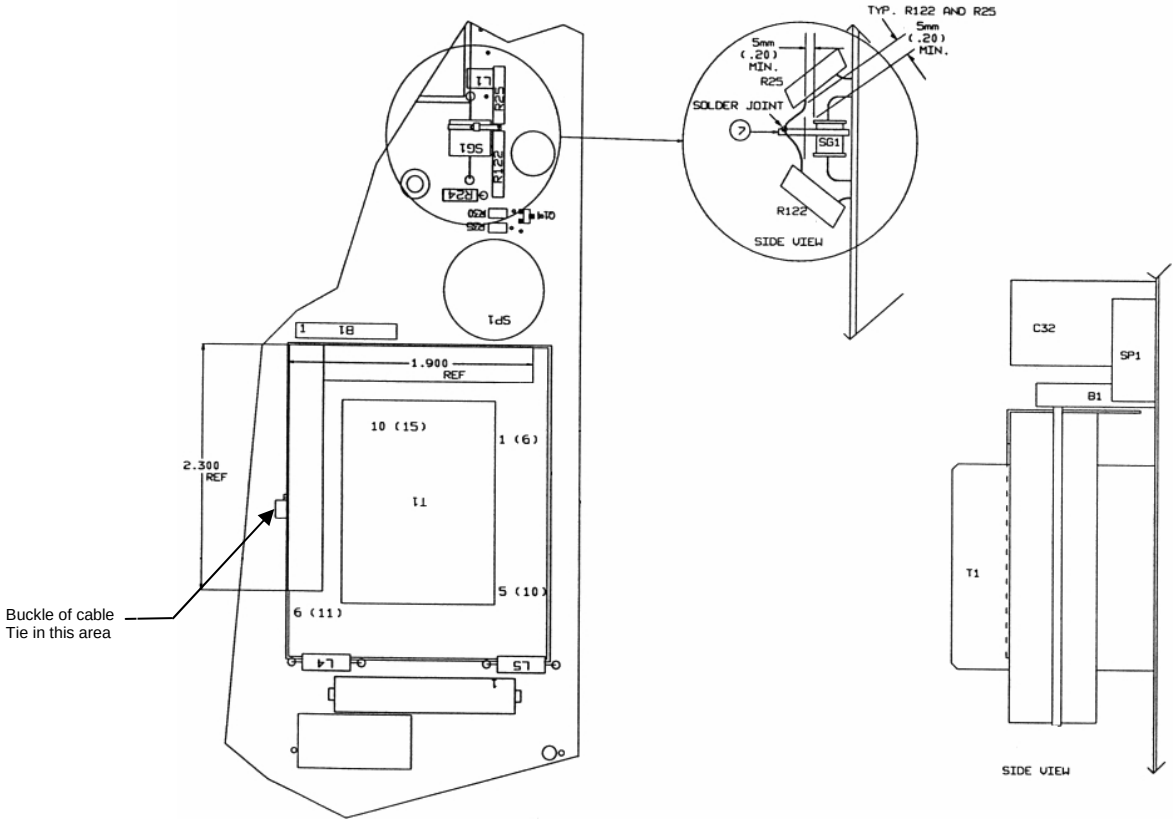


Figure 7-d Modification Detail for Motherboard

See assembly notes on the following page.

Motherboard Assembly Notes:

- The following components are not installed: C18, C21, C48, C58, C84, R5, R21, R28, R102, D22, J3, SW1.
- Cut leads shall not extend >.10 Maximum above surface of board.
- After all components have been soldered to the board, remove protective tape on piezo (SP1).
- See modification detail above:
  - Add R122 in series with R25 as shown. The joint between resistors to have the leads bent fully around each other. Then soldered.
  - Leads of R25 and R122 must be a minimum of 5mm (.20") away from SG1.
  - Add cable tie around spark gap (SP1) and resistor joint
    Do not tighten cable tie enough to bend leads.
  - Add mylar shield between transformer and parts above and to the left of T1.
  - Secure mylar shield to the transformer using cable tie.

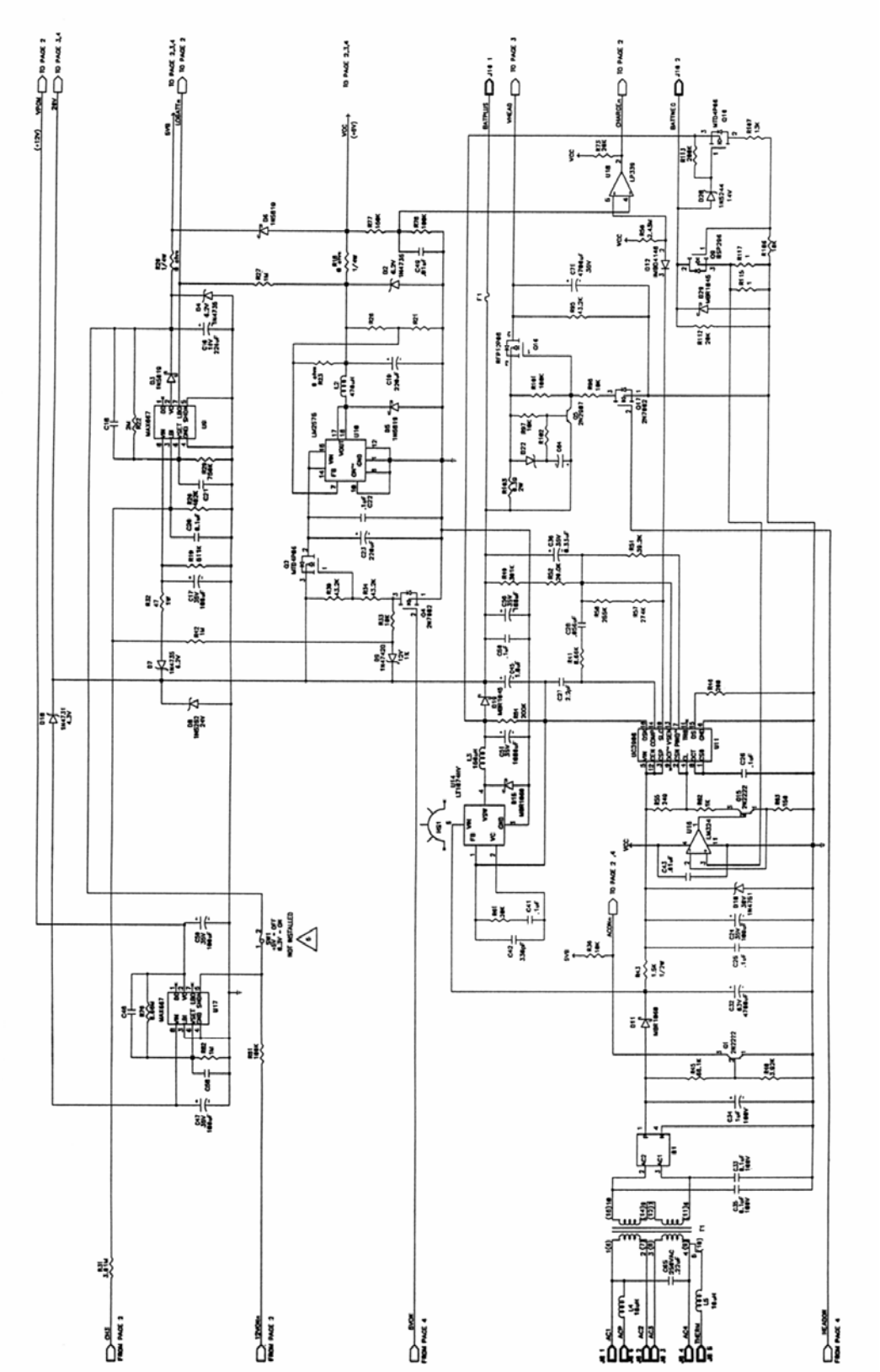


Figure 7-e Sheet 1 of Motherboard Schematics

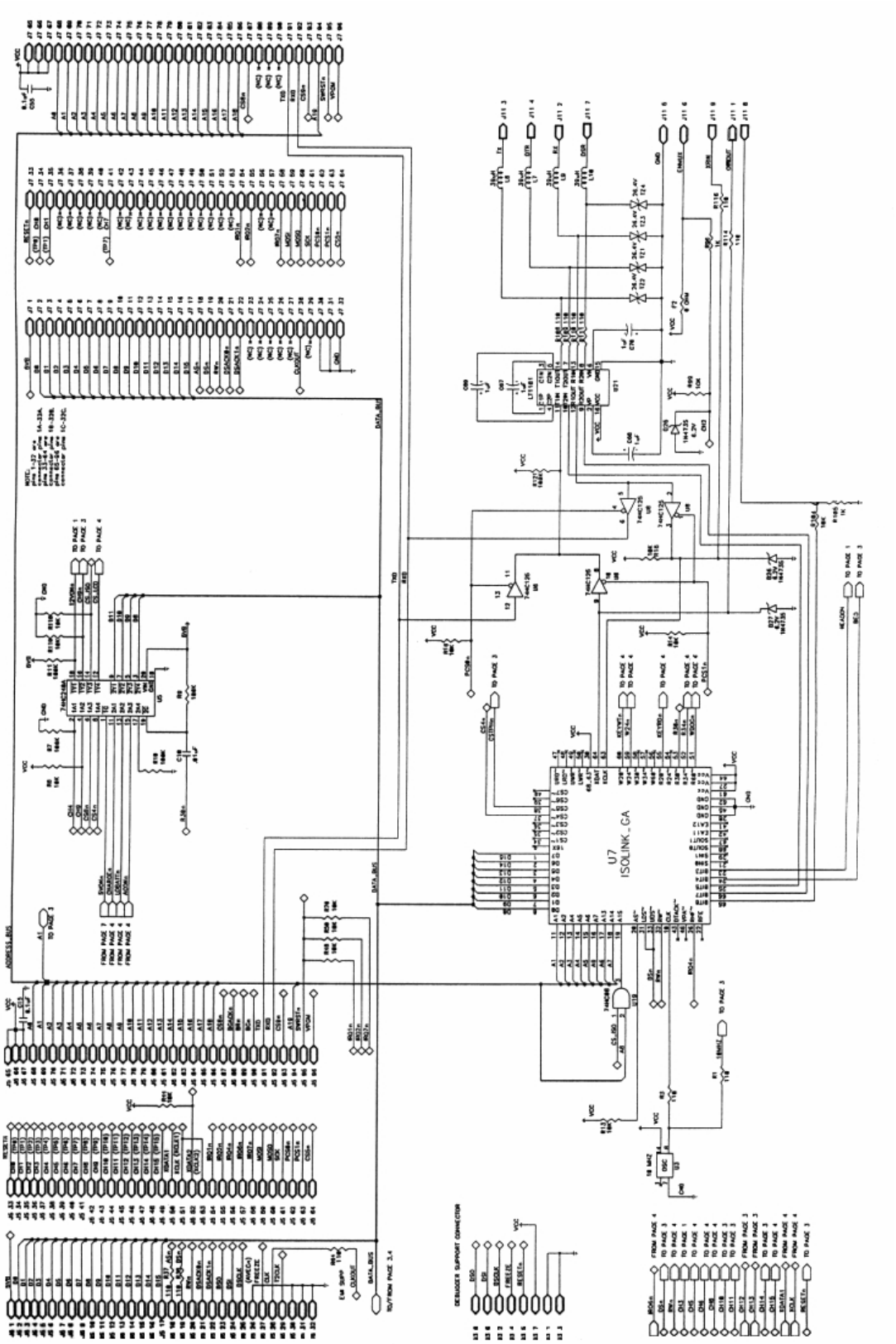


Figure 7-f Sheet 2 of Motherboard Schematics

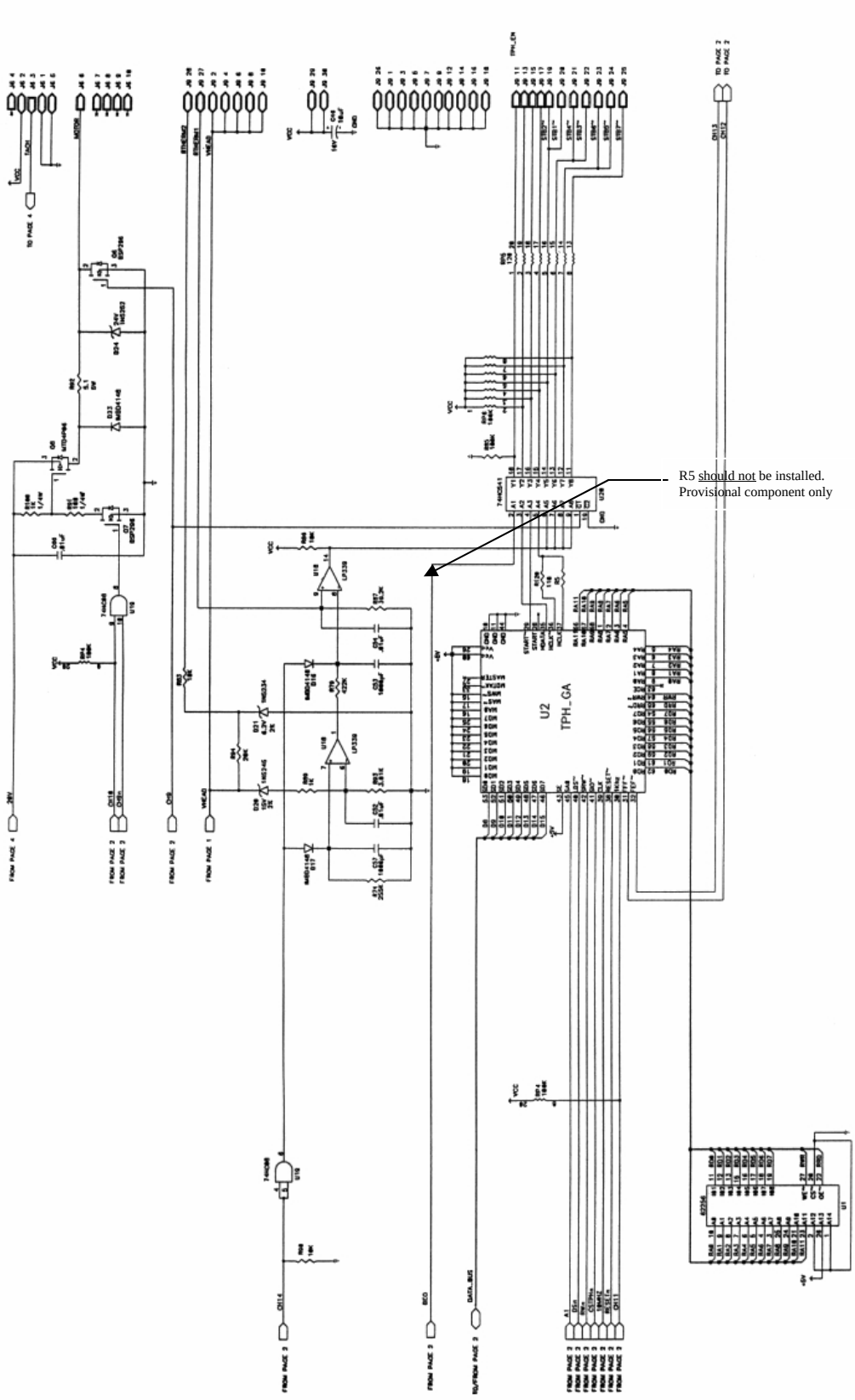


Figure 7-g Sheet 3 of Motherboard Schematics

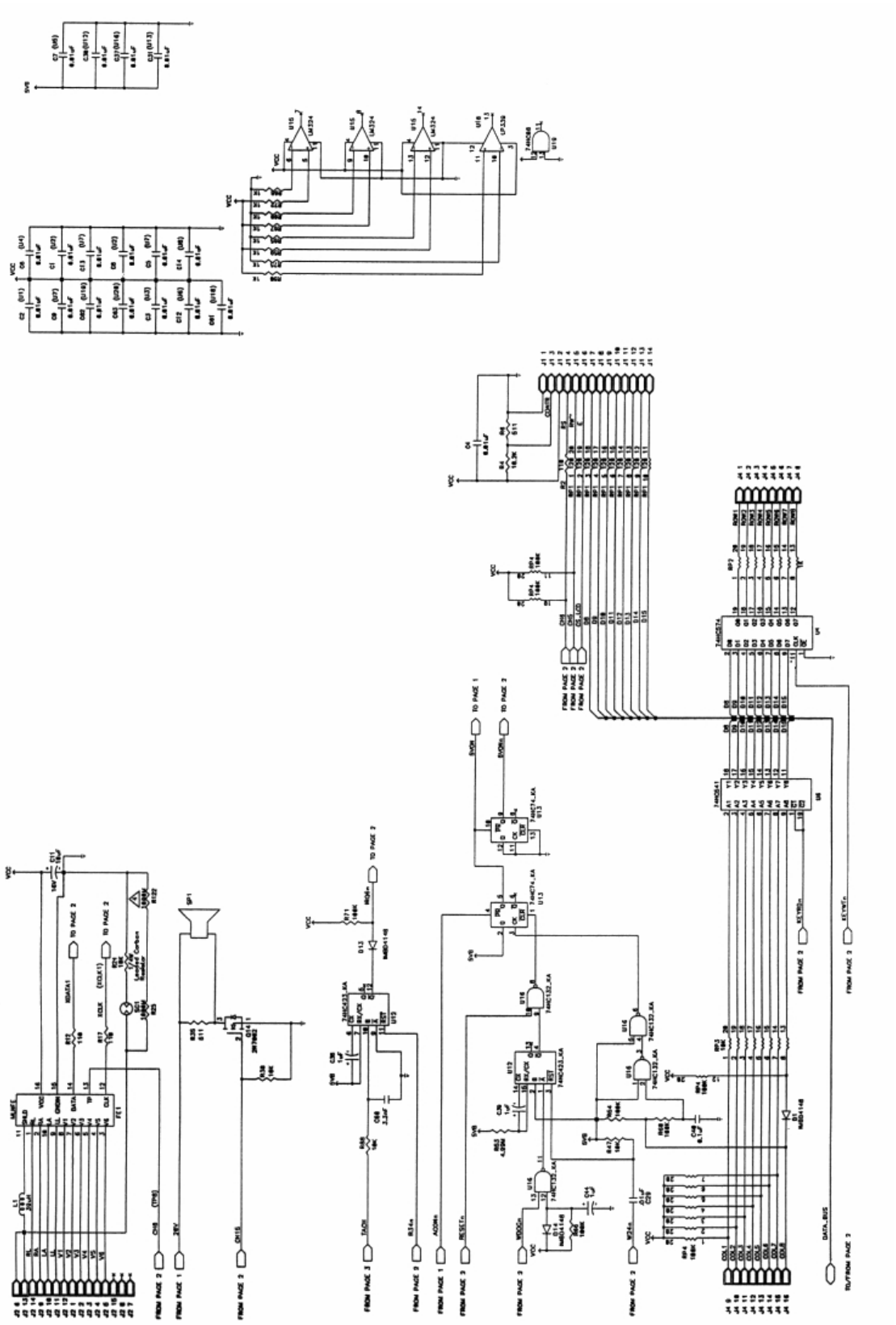
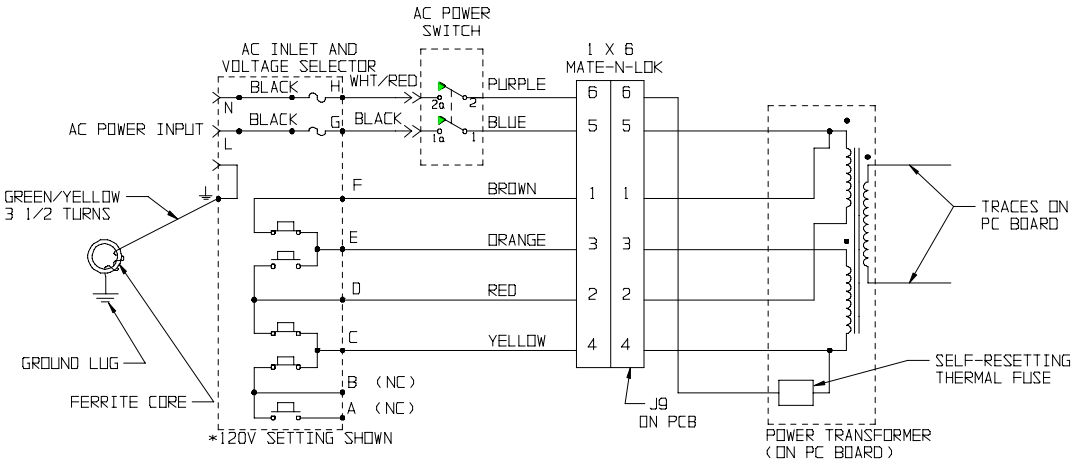
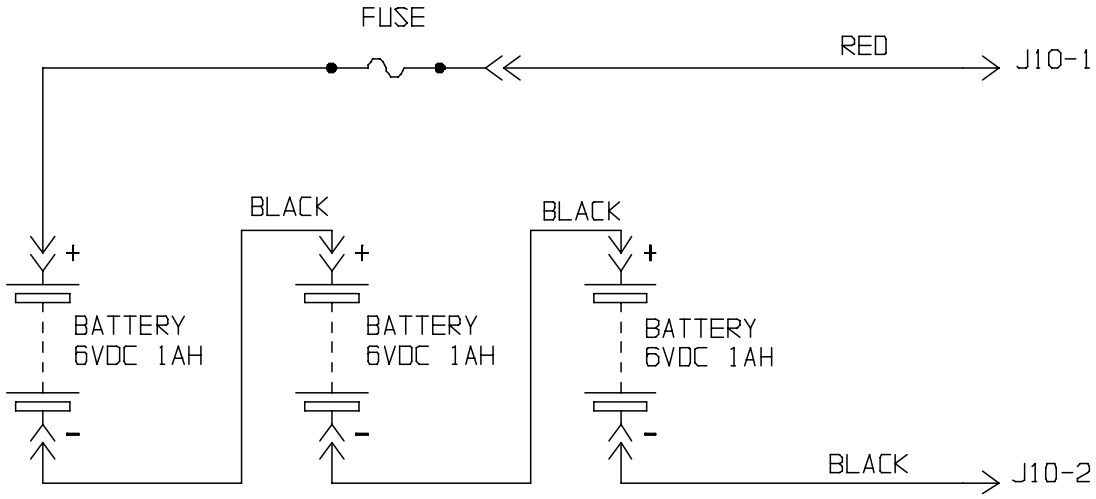


Figure 7-h Sheet 4 of Motherboard Schematics



ELI 100
AC INPUT POWER
INTERCONNECT DIAGRAM

AC VOLTAGE SELECTOR				
	TUMBLER SETTING			
SWITCH	100V	120V*	220V	240V
A-B	CLOSED	OPEN	CLOSED	OPEN
B-C	OPEN	CLOSED	OPEN	CLOSED
C-D	CLOSED	CLOSED	OPEN	OPEN
D-E	OPEN	OPEN	CLOSED	CLOSED
E-F	CLOSED	CLOSED	OPEN	OPEN



INTERNAL DC POWER

Figure 7-i Sheet 5 of Motherboard Schematics

Mortara Processing Module (MPM) Board Ref: 26025-005-50

Anti-Static equipment should always be worn when working with static sensitive devices.

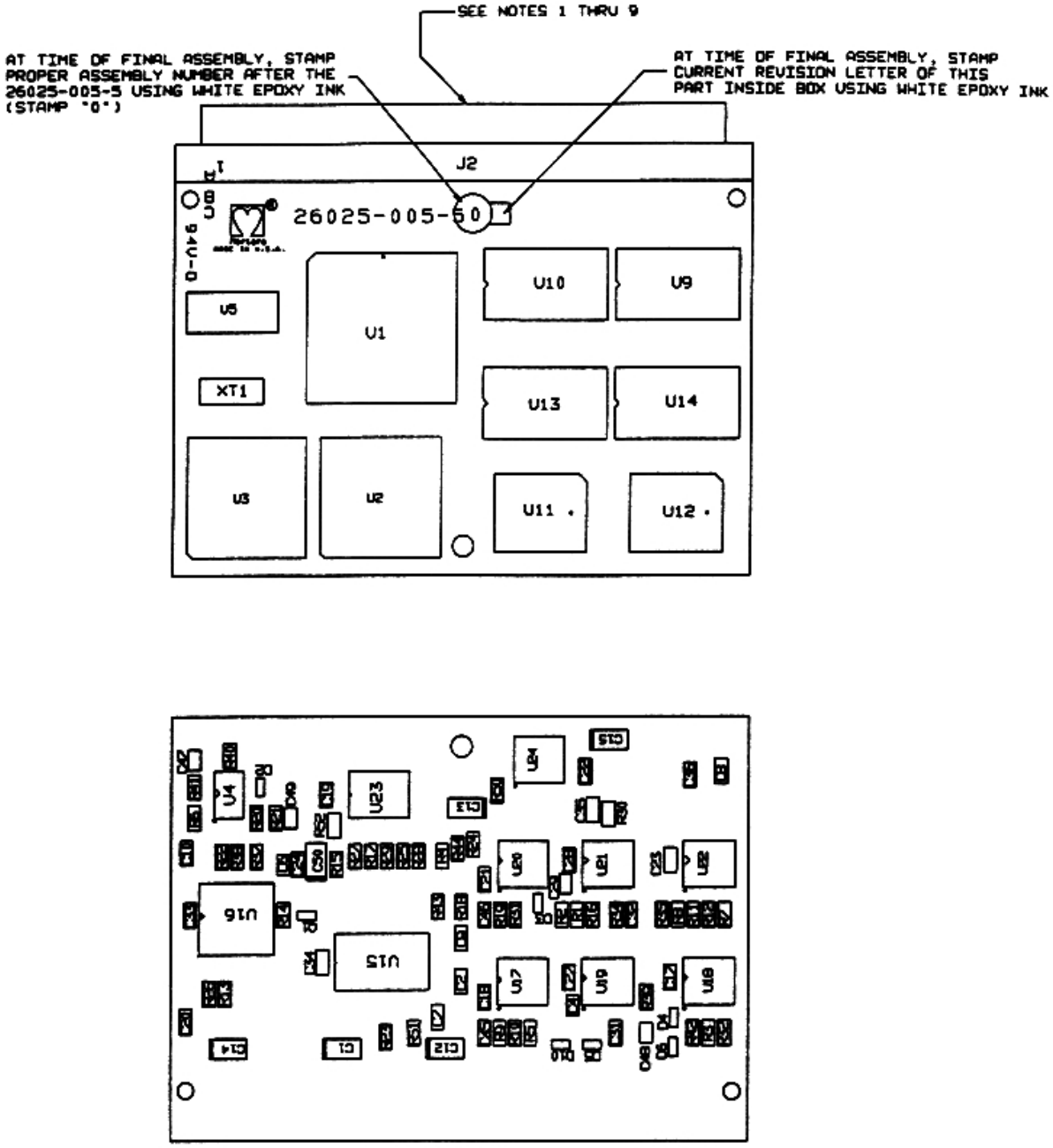


Figure 7-j Processing Module (MPM) Printed Circuit Board

Processing Module Assembly Notes:

Procedure for pressing the 96 Pin Din Connector into the printed circuit board:

- Wearing static sensitive equipment and being in a static sensitive area is required while performing this task.
- The Mortara Processing Module (MPM) Circuit Card (Ref 5525-004-01) must be fully assembled before the connector J2 is inserted.
- Break apart each fully assembled MPM Circuit Card from the four-panel array. Be sure to remove all break out tabs from each MPM Circuit Card. Remove the clamping bar from the MPM Circuit Card connector assembly fixture (Ref 90000-015-50).
- With your hands, press the 96 Pin Din Connector (Ref 3308-097), into holes marked J2 on the top of the MPM Circuit Card. The top of the MPM Circuit Card is defined as the side of the circuit card which has U1 located on it. The 96 Pin Din Connector must be on the same side of the MPM Circuit Card as U1. Be very careful not to bend any of the pins on the 96 Pin Din Connector.
- Be sure the all of the pins of the 96 Pin Din Connector are into the holes on the MPM Circuit Card. Temporarily turn the MPM Circuit Card over to see that each pin on the connector is properly located in the MPM Circuit Card holes.
- Place the MPM Circuit Card, along with the 96 Pin Din Connector, onto the MPM Connector assembly fixture. The MPM Circuit Card must have component U1 and the 96 Pin Din Connector facing up when the card is placed onto the fixture. There are two mounting holes on the 96 Pin Din Connector that are in line with two holes on the MPM Circuit Card. Place the MPM Circuit Card onto the connector assembly fixture so that the small locator pins on the connector assembly fixture slide through the 96 Pin Din Connector and the MPM Circuit Card mounting holes. The MPM Circuit Card should be situated so that the large mounting hole, which is located opposite the 96 Pin Din Connector, is resting on the support screw of the connector assembly fixture. Be sure all of the connector pins are properly registered in the MPM Circuit Card holes before trying to press the connector with the arbor press.
- Look at the clamping bar that was removed from the connector assembly fixture. Note that there is a grooved step on one side of the clamping bar. There is a corresponding step on the 96 Pin Din Connector on the MPM Circuit Card. Place the clamping bar onto the assembly fixture by sliding the clamping bar over the large guide pins. Stepped groove on the clamping bar must match the step on the 96 Pin Din Connector.
- Place the entire fixture into an arbor press.
- Rest the arbor press ram on top of the connector assembly fixture clamping bar. Note: A minimum pressing force of 1.5 tons is required for pressing the connector into the MPM Circuit Card.
- Use the arbor press to press the connector into the MPM Circuit Card so the supports on the 96 Pin Din Connector are flush with the MPM Circuit Card.
- Remove the MPM Circuit Card from the fixture.
- Soldering the connector will not be required because of the tight fit accomplished by using the press fit mothod.
- For 26025-005-51 assembly only, do not install R6, R8, R10, and R12.
- Place the assembled board into a static protected bag.

TOP SIDE COMPONENTS			BOTTOM SIDE COMPONENTS			BOTTOM SIDE COMPONENTS			BOTTOM SIDE COMPONENTS		
REF-DES	"X"	"Y"	REF-DES	"X"	"Y"	REF-DES	"X"	"Y"	REF-DES	"X"	"Y"
U1	1325	1575	C1	1100	2125	R1	2600	1275	U15	1350	1575
U2	1325	500	C10	100	875	R10	2200	2025	U16	425	1300
U3	475	500	C12	1750	2125	R11	3350	1275	U17	2250	1700
U5	375	1675	C13	1885	585	R12	3450	1275	U18	3450	1700
U9	3225	1850	C14	375	2125	R13	350	1775	U19	2800	1700
U10	2375	1850	C15	2800	150	R14	725	1275	U20	2250	950
U11	2350	400	C16	1010	1200	R15	1065	950	U21	2800	950
U12	3225	400	C17	3200	1675	R16	2700	1275	U22	3450	950
U13	2375	1100	C18	2000	1800	R17	1275	900	U23	1300	500
U14	3225	1100	C19	1000	500	R18	1850	1225	U24	2350	275
XT1	375	1175	C2	1850	1700	R19	2100	1275	U4	375	500
			C20	100	1950	R2	2500	1275			
			C21	2000	1050	R20	550	650			
			C22	2650	350	R21	675	650			
			C23	3200	925	R22	325	900			
			C24	820	950	R23	1375	2050			
			C27	2550	1675	R24	1925	825			
			C28	2550	925	R25	1475	900			
			C29	2525	1075	R26	250	1775			
			C31	2850	2025	R27	1175	900			
			C32	2950	1275	R28	1575	900			
			C33	125	1275	R29	1375	900			
			C34	975	1575	R3	3450	2025			
			C35	2700	600	R30	2800	625			
			C36	3325	375	R31	2200	1275			
			C4	2575	1850	R32	3550	2025			
			C45	2000	2025	R34	2850	1275			
			C46	2000	1275	R35	3150	1275			
			C47	150	275	R37	550	900			
			C48	3050	2025	R38	425	900			
			C49	775	650	R39	3050	1800			
			C50	940	930	R4	1725	900			
			C6	730	950	R40	375	250			
			C7	1700	1925	R41	150	450			
			C8	3525	350	R42	3350	2025			
			C9	1850	1425	R43	1700	1225			
			D10	2500	2100	R44	1825	850			
			D2	575	450	R5	2300	2025			
			D3	2350	1200	R50	2075	475			
			D4	3225	1930	R51	1550	2025			
			D5	2700	2100	R52	1050	700			
			D6	3220	2115	R6	150	650			
			J2	300	2505	R7	3550	1275			
			Q1	875	1275	R8	3250	1275			
						R9	2100	2025			

Figure 7-k Processing Module Card (MPM) 'X' & 'Y' Coordinates Ref: 26025-005-50 and 26025-005-51

Dimensions are in mils, 1.e; 2950 = 2.950, these are to the center of each component or devices.

Mortara Processing Module (MPM) Board Ref: 26025-005-51

Anti-Static equipment should always be worn when working with static sensitive devices.

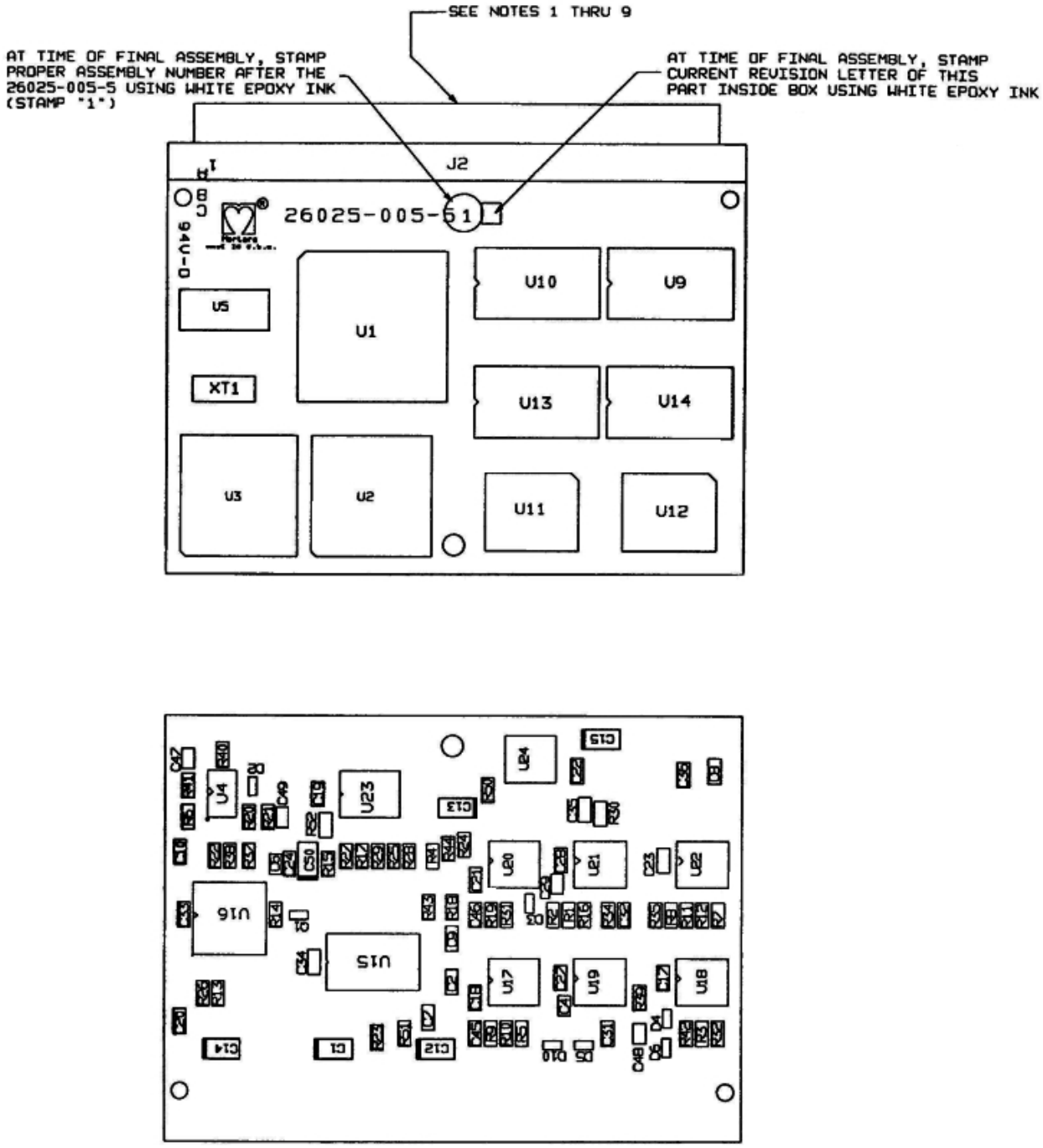


Figure 7-l Processing Module (MPM) Printed Circuit Board

Processing Module Assembly Notes:

Procedure for pressing the 96 Pin Din Connector into the printed circuit board:

- Wearing static sensitive equipment and being in a static sensitive area is required while performing this task.
- The Mortara Processing Module (MPM) Circuit Card (Ref 5525-004-01) must be fully assembled before the connector J2 is inserted.
- Break apart each fully assembled MPM Circuit Card from the four-panel array. Be sure to remove all break out tabs from each MPM Circuit Card.
- Remove the clamping bar from the MPM Circuit Card connector assembly fixture (Ref 90000-015-50).
- With your hands, press the 96 Pin Din Connector (Ref 3308-097), into holes marked J2 on the top of the MPM Circuit Card. The Top of the MPM Circuit Card is defined as the side of the circuit card which has U1 located on it. The 96 Pin Din Connector must be on the same side of the MPM Circuit Card as U1. Be very careful not to bend any of the pins on the 96 Pin Din Connector.
- Be sure the all of the pins of the 96 Pin Din Connector are into the holes on the MPM Circuit Card. Temporarily turn the MPM Circuit Card over to see that each pin on the connector is properly located in the MPM Circuit Card holes.
- Place the MPM Circuit Card, along with the 96 Pin Din Connector, onto the MPM Connector assembly fixture. The MPM Circuit Card must have component U1 and the 96 Pin Din Connector facing up when the card is placed onto the fixture. There are two mounting holes on the 96 Pin Din Connector that are in line with two holes on the MPM Circuit Card. Place the MPM Circuit Card onto the connector assembly fixture so that the small locator pins on the connector assembly fixture slide through the 96 Pin Din Connector and the MPM Circuit Card mounting holes. The MPM Circuit Card should be situated so that the large mounting hole, which is located opposite the 96 Pin Din Connector, is resting on the support screw of the connector assembly fixture. Be sure all of the connector pins are properly registered in the MPM Circuit Card holes before trying to press the connector with the arbor press.
- Look at the clamping bar that was removed from the connector assembly fixture. Note that there is a grooved step on one side of the clamping bar. There is a corresponding step on the 96 Pin Din Connector on the MPM Circuit Card. Place the clamping bar onto the assembly fixture by sliding the clamping bar over the large guide pins. Stepped groove on the clamping bar must match the step on the 96 Pin Din Connector.
- Place the entire fixture into an arbor press.
- Rest the arbor press ram on top of the connector assembly fixture clamping bar. Note: A minimum pressing force of 1.5 tons is required for pressing the connector into the MPM Circuit Card.
- Use the arbor press to press the connector into the MPM Circuit Card so the supports on the 96 Pin Din Connector are flush with the MPM Circuit Card.
- Remove the MPM Circuit Card from the fixture.
- Soldering the connector will not be required because of the tight fit accomplished by using the press fit mothod.
- For 26025-005-51 assembly only, do not install R6, R8, R10, and R12.
- Place the assembled board into a static protected bag.

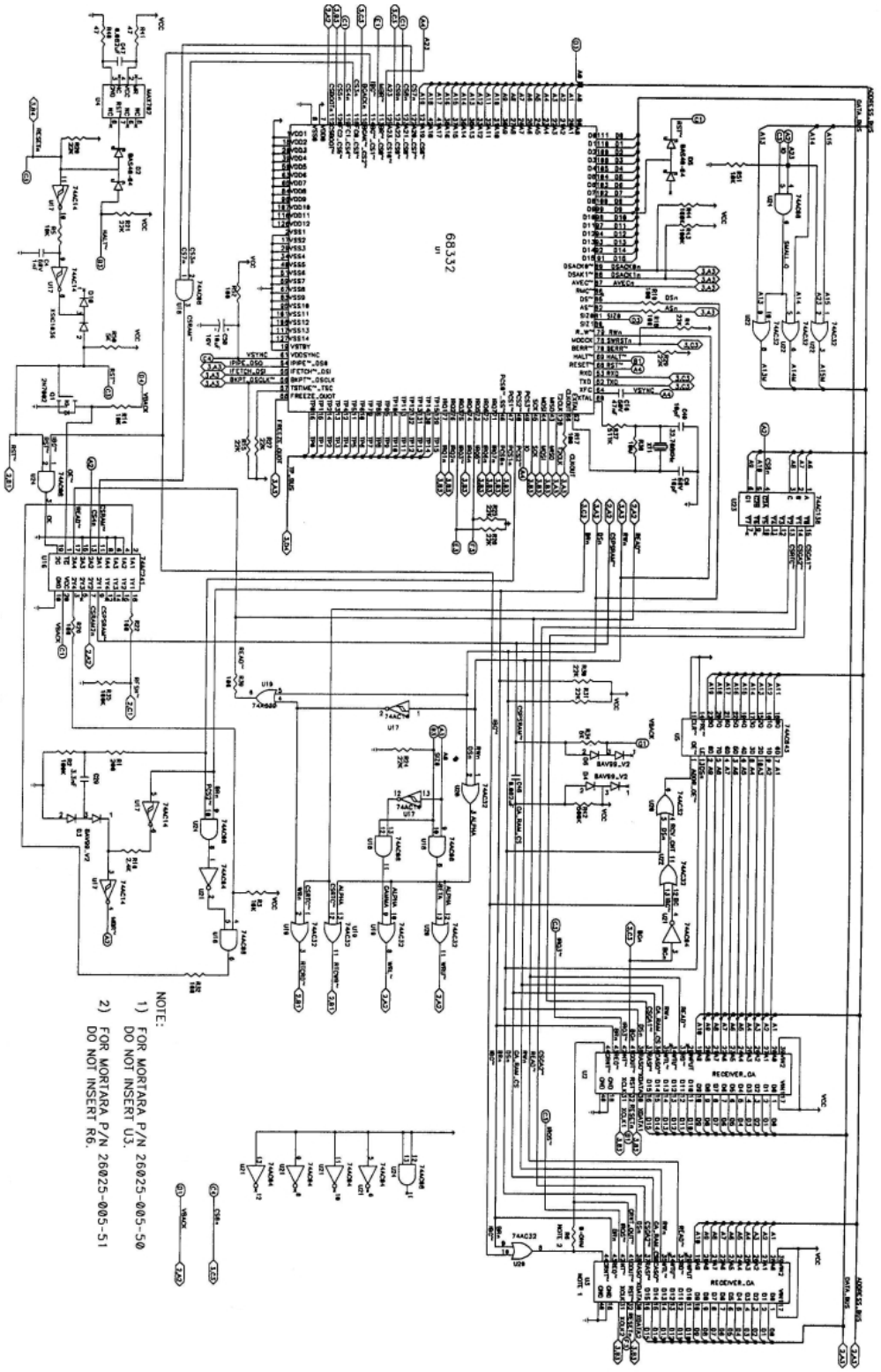


Figure 7-m Sheet 1 of 3 Schematics for Processing Module (MPM)
Ref: 26025-005-50 and -51

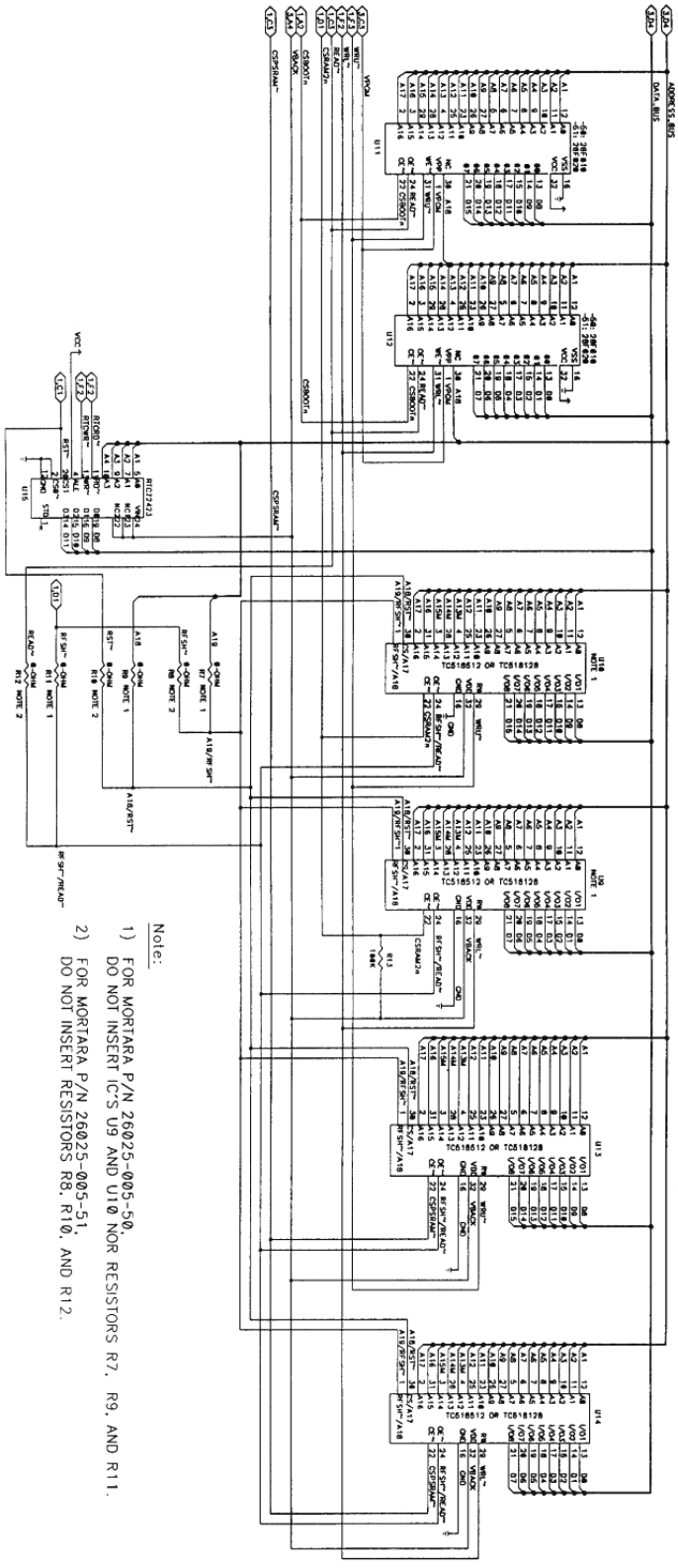

Note:
1) FOR MORTARA P/N 26025-005-50,
DO NOT INSERT IC'S U9 AND U10 NOR RESISTORS R7, R9, AND R11.
2) FOR MORTARA P/N 26025-005-51,
DO NOT INSERT RESISTORS R8, R10, AND R12.

Figure 7-n Sheet 2 of 3 Schematics for Processing Module (MPM)
Ref: 26025-005-50 and -51

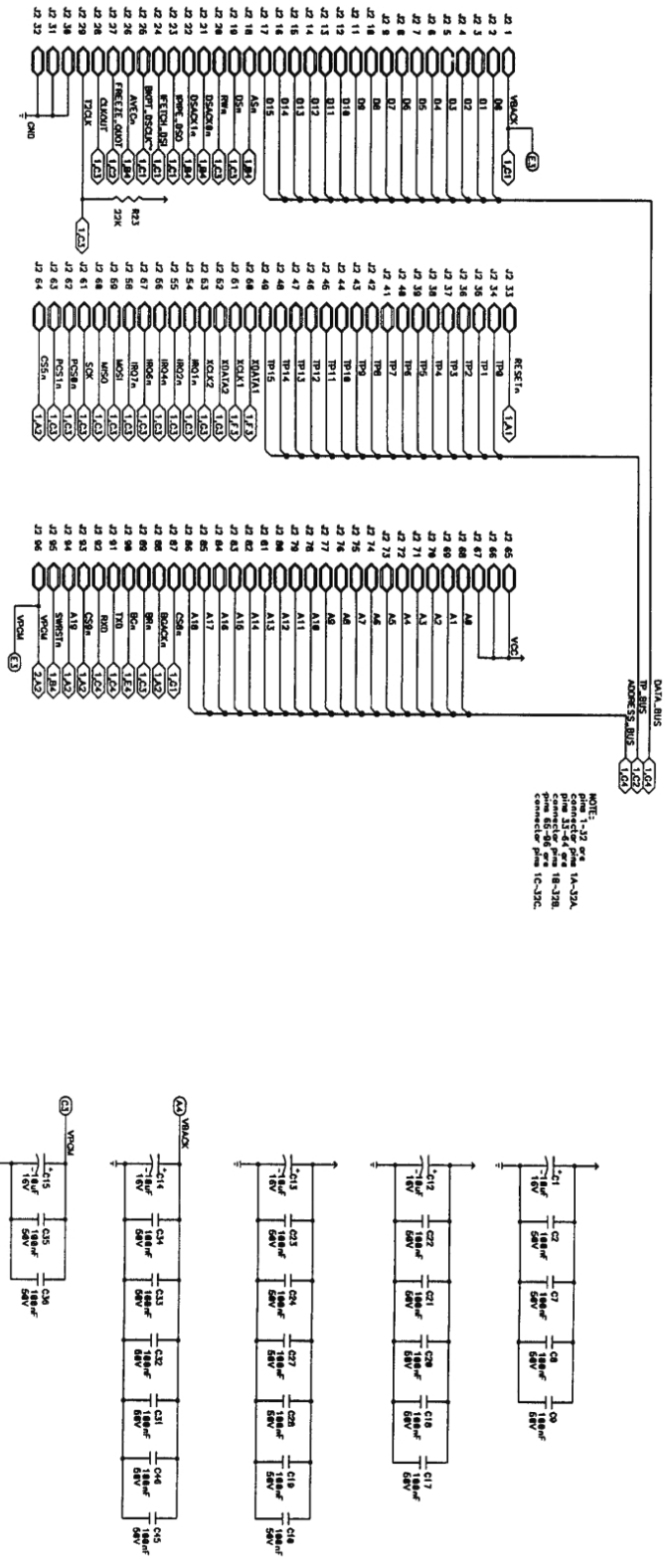


Figure 7-o Sheet 1 of 3 Schematics for Processing Module (MPM) Ref: 26025-005-50 and -51

8 Testing and Troubleshooting

Equipment Required

See “Performance Testing" later in section.

NOTE: An oscilloscope may be necessary to isolate between a faulty printhead or the circuit board.

Introduction

Since repair of the ELI 100 is limited to replacement of subassemblies, including the processor module, modem module, or the entire motherboard, the troubleshooting guide does not extend to the component level. However, a hardware description, schematic, and an assembly drawing are provided in other parts of this manual in case of on-site modifications or emergency repairs.

In order to avoid confusion with regard to differences in display menus or messages, the processor module should be loaded with the latest revision of software. Also, remove the battery fuse during any disassembly necessary for servicing.

Fault Isolation Table:

Trouble Symptoms	Diagnosis
AC On – Blank LCD, no pixels illuminated.	See Diag. 1.0
AC On – Bar across top of LCD or faint illumination of pixels.	See Diag. 2.0
AC On – “Charging” message appears but characters are missing with or without spaces between.	See Diag. 2.0
AC On – Any other message is displayed other than “charging.”	See Diag. 2.0
DC On – “Battery Low” message appears on display.	See Diag. 3.0
DC On – No response when key is pressed.	See Diag. 4.0
DC On – Bar across top of LCD or faint illumination of pixels (unit stays on).	See Diag. 2.0
DC On – Bar across top of LCD or faint illumination of pixels (unit shuts off).	Replace circuit board
Self test fail, error message, or unit locks up in any display mode.	Replace circuit board
Cannot access clock menu or change date and time.	Replace circuit board
Noise/drift test failure.	Replace circuit board
Keyboard test – No response to key press, no audio.	Install test keyboard. If it still fails, replace circuit board
Keyboard test – Key press response on display, but no audio.	See Diag. 5.0
ECG test – Will not recognize leads or excessive noise.	Replace circuit board
ECG test – Communication error.	Replace circuit board

Fault Isolation Table continued:

ECG test – Locks up or will not complete analysis (no interpretation printout).	Replace circuit board
Won't save ECG.	Is directory full? Replace circuit board
Fails calibration pulse alignment.	See 3.0, removal and replacement of printhead. Check writer motor
Writer test – Printhead too light or too dark, or uneven.	See Diag. 6.0
Writer test – Gaps in printing, missing dots, or no printing at all.	See Diag. 7.0
Writer test - Unit shuts down or motor drive stops when trying to print.	See Diag. 7.0
Writers test – No motor drive.	See Diag. 8.0
Writer test – Motor drive erratic or noisy; paper speed out of tolerance.	See Diag. 8.0
Leads fail tests – No fail indication or constant fails indication.	Check Patient Cable for corrosion or dried gel deposits. Check tightness of alligator clips; then replace circuit board
Fails direct receive or transmit tests.	Check unit-to-unit cable; then replace circuit board. Check baud rates of each unit for matching rates
Fails modem receives or transmits tests.	Check phone line connections (multiline? dedicated line?); then replace circuit board
No dial tone or touch-tone audio during modem tests.	See Diag. 8.0

Diagnosis:

1.0 Ac On - Blank LCD, No Pixels Illuminated

1.1 Remove AC and battery power from the unit. Connect the test LCD assembly to J1. Turn on the AC power again and verify whether or not the problem is the LCD or one of the circuit boards. Replace the LCD, the processor module or the motherboard.

1.2 Check both line fuses for continuity, and verify that the voltage selector is at the proper setting for the line voltage.

1.3 Disconnect the violet wire from J8 and the blue wire from J8. Connect a multimeter set up for AC volts across the 2 wires. Turn on the AC power switch. The multimeter should read the line voltage. If it does not, check across the AC power switch terminals that the blue and violet wires connect to; then check across the black and red/white wires connect that plug into the other set of switch terminals. If the voltage is present at the black and red/yellow wires, replace the switch. If not, then replace the AC connector assembly. If the voltage is present across the blue and violet wires, continue.

1.4 Connect the negative lead of the multimeter, set up for DC volts, to the anode of D 15. Connect the positive lead to the cathode of D19. Approximately + 20 VDC should be present. If not, replace the circuit board.

1.5 Connect the positive lead of the meter to either side of R18. + 5 VDC +/- 0.25 VDC should be present. If not, replace the circuit board.

2.0 AC On – Bar Across Top of LCD or Faint Illumination of Pixels

2.1 Remove power from the unit. Connect the test LCD to J1, and turn on the AC power switch. If the ”CHARGING” or "AC POWER” message comes up, replace the unit’s LCD assembly. If not, replace the circuit board.

2.2 With a multimeter set up for DC volts, measure between the anode of D15 (neg. lead) and either side of R18 (pos. lead). The voltage should be + 5.0 +/- 0.25 VDC. If not, then replace the circuit board.

3.0 DC On – “Battery Low” Message Appears on Display

NOTE: Battery voltage should be measured with the unit on so that batteries are under load (Battery power only).

3.1 With a multimeter set up for DC Volts, measure across each individual set of battery terminals. The voltage should be + 6.0 VDC minimum. If it is between + 4.0 and + 6.0 VDC, put the unit on charge. Otherwise, replace the low battery.

3.2 Connect the negative lead from the meter to the anode of D15 and positive lead to the cathode of D19. The voltage should be + 18.0 VDC minimum. Disconnect one of the battery leads and connect a DC ammeter in series. The keep-alive current should be less than 500 µA. If it is greater, replace the circuit board.

NOTE: If the batteries are disconnected, any ECGs stored in memory or any special set up parameters, including date and time, will be lost.

3.3 Press the keyboard DC ON key. If the unit comes up in the set up menu, exit to Main Menu. Check for the “battery low” message.

4.0 DC On – No Response when DC 'ON' Key is pressed

4.1 Refer to Section 3.0 for battery testing and keep-alive current measurement. If the batteries check out good and the current is below 500 µA, check the voltage on either side of R300. It should be approximately + 4.4 VDC. Press the DC ON key the keyboard. The voltage should rise to + 5.0 VDC +/- 0.25 VDC. If it does, but nothing is visible on the display, then substitute the test LCD to verify whether or not the LCD in the unit is working. If the test LCD remains blank, try pressing some of the keyboard keys and listen for the key click from the speaker.

4.2 If the + 5V does not turn on, the LCD is blank, or there is no key click, then disconnect the keyboard at J4 and plug in a test keyboard. If this fails, replace the main circuit board. Otherwise, replace the unit’s keyboard.

5.0 Writer Test - Printing Too Light or Too Dark or Uneven

5.1 The printing intensity is affected by three different factors:

A. Available power to the head (batteries)

B. The print strobe pulse width

C. Mechanical alignment

5.2 The print strobe duty cycle is generated automatically by the hardware. The period of the strobe is approximately 1 mS 50 MM/Sec. The on time (active low) should be about 500 µsec. at all speeds. This can be observed if an oscilloscope is available by probing U20 pin 12.

5.3 Install a roll of thermal ECG paper into the writer. The unit should be powered up in the Main Menu. Select 50 MM/Sec. paper speed and 20 MM/MV sensitivity. Press “RHY”,

then “Stat”. Examine the calibration pulses printed in all 3 channels. The rising and falling edges as well as the top should be smooth lines with no fading or strings of individual dots. They should also not be extremely dark or thick (uneven thickness or scorch marks). If the printing is extremely light or dark, check the battery voltage; then replace the circuit board.

5.4 For uneven printing, power up the unit and select the Main Menu. Simultaneously press “ALT” and “0”, then “ALT” and “T”. The writer self-test is initiated by pressing CONTINUE. Examine the ramp on the printout. It should be a smooth, 45-degree diagonal line, which extends across the entire grid portion of the paper, without any gaps or uneven darkness areas. If there is a problem, check that all four printhead-mounting screws are tightened evenly and that the front of the printhead is flush with the front of the mounting plate. If the problem persists, possible causes could be:

A. The printhead

B. The platen or the mechanical alignment of the writer chassis (replace the entire writer).

6.0 Writer Test - Gaps in Printing, Missing Dots, or No Printing at All

6.1 Refer to step 5.0 in order to check printing quality. If there are sizeable gaps in the ramp or no printing at all, check the head power/data ribbon cable (REF 25018-011A). This is the 30-conductor cable, which plugs in between the board and the head. If the cable has no shorts, opens, or damaged connectors, then the problem could be caused equally by either the printhead or the circuit board. If there are individual dots missing, however, the printhead is at fault.

6.2 In order to isolate the problem to the printhead or the circuit board, an oscilloscope is needed. First, check the batteries to verify that the combined voltage is greater than + 18 VDC. Then check pin 2 of Q16 with a multimeter and verify that VH is present (greater than + 18 VDC) when the writer is running. Next, using an oscilloscope, check U20 pins 11 through 18. Refer to the portion of the schematic that shows the printhead drive circuitry. U20 pins 11, 12, 13, 14 (STB 1* - STB7*) should be varying duty cycle pulses of approximately 1.6 MS period at 25 MM/Sec. paper speed. U20 pin 15 (clock) should be bursts of 3MHZ clock pulses with the interval between bursts varying at the same rate as the strobes. U20 pin 16 (latch*) should be very narrow negative going pulses (less than 200 NSec.) spaced at wide intervals. U20 pin 17 (data) should be positive going pulses varying in interval. U20 pin 18 (enable) should go from 0V to +5V as soon as the writer starts running. If all these signals are present, the problem is the printhead or the ribbon cable. If not, replace the circuit board.

7.0 Writer Test – No Motor Drive

7.1 This problem could be caused equally by either the writer or the circuit board. First, install a roll of thermal paper and close the writer lid. Gently pull on the protruding strip of paper and verify that there is sufficient tension and no slipping. The drive gears should turn smoothly. Do not pull too hard as this may damage the motor.

7.2 Measure the combined battery voltage. It should be greater than + 18 VDC. Next, connect a voltmeter between the drain of Q6 and return (the anode of D15).

7.3 Power up the unit from the keyboard and select the Main Menu. Select 5 MM/Sec. paper speed. Press “RHY”, then “Stat”. Sequence through all the paper speeds and note the DC voltage readings. They should be as follows:

Approximately + 2 VDC at 5 MM/Sec.

Approximately + 3 VDC at 10 MM/Sec.

Approximately + 5.5 VDC to 6 VDC at 25 MM/Sec.

Approximately + 10 VDC at 50 MM/Sec.

If the voltages are not present, replace the main circuit board. If they are too high (+10 to + 18 VDC at 5 MM/Sec.) the problem is most likely an open wire in the cable or the motor. Replace the writer motor assembly. If the voltages are normal, replace the writer motor assembly.

8.0 Modem Test - No Dial-Tone or Touch-Tone Audio

8.1 Perform the modem test as described in the "minimum performance testing" section. If the modem transmission does not function, replace the modem cord.

Performance Testing

Introduction

The test procedure is based on the factory Quality Assurance Final Test Procedure, but it is not identical, and need not necessarily be performed in the exact order in which the tests are listed. However, the troubleshooting guide in section 2.0 corresponds sequentially to the performance tests as far as the type of trouble symptoms, which may be encountered.
Sample traces of tests which include a writer print-out are provided in section 10.0 as an aid for diagnosis of problems. Some of these traces were derived using the 10-Lead Bio-Tek Model ECG-1 Simulator. If a different simulator is used for performance testing the operator must be familiar with the correct waveform output of the type used.
If it is necessary to perform the transmit/receive tests, then another ELI 100 which is fully functional is required. For the direct transmit/receive tests, this unit must be available at the servicing site, along with the proper interconnect cable. For the modem transmit/receive tests, however, the unit used for test may be located at a remote installation.
Leakage tests description and diagrams for class 1 category CF medical equipment are provided in section 9.0. These tests should be performed any time the writer, the circuit board assembly, the AC connector or the AC switch assembly are removed and replaced. Any AAMI and/or IEC approved Leakage tester may be used.

Equipment Required

10-Lead Bio-Tek ECG-1 Simulator or Equivalent

Patient Data Input Shorting Plug.

Resting Patient Cable with American Marking (P/N: 9293-010-50).

Roll of Thermal 4" ECG Paper (P/N: 9100-004).

Fully Functional ELI 100 with Baud Rate set at 9600 or 38400 for Direct Transmit/Receive.

Test LCD Assembly (P/N: 14000-004) for troubleshooting.

Test Keyboard, for troubleshooting.

Digital Multimeter and Test Leads for troubleshooting.

Oscilloscope and Probes for troubleshooting Printhead Control Circuits.

Test Equipment Set-Up

Connect the ELI 100 to a Mains Power Source (120V or 240V), making sure the 120V/240V switch, located on the rear of the unit, is set accordingly.

Connect the Patient Cable to the Simulator.

Connect the Shorting Plug to the Patient Input Port.

Install the roll of ECG paper

Initial Set-Up

Note: ***Insure a beep is heard every time a key is pressed during the performance Test.***

Turn ON the unit's main power switch, located at the rear. The message "CHARGING" or "AC POWER" should appear on the LCD. Press the DC ON key on the keyboard. The message "SELF TEST" should appear momentarily on the LCD, followed by "Configuration Error" followed by the first screen of the configuration parameters, indicating the following:

```
AC                STORAGE
FILTER: 60Hz      FORMAT          EX
```

Illustration 1

Move through the options, and set the default parameters as follows:

AC Filter	Storage Format: 2.5s	Press ENTER
Plot Format: INT	Interp Format: REA	Press ENTER
Plot Freq: 100 Hz	Plot Channels: STD	Press ENTER
Units: LB/IN	Date Format: US	Press ENTER
Baud Rate: 38400	Auto Delete: off	Press ENTER
Phone Number:		Press ENTER
Auto Save : ON		Press ENTER
Site #:, Cart #:, Copies: 0, Retrieve Serials: 0		Press ENTER four times
ID Format: Long		Press ENTER
Rhythm Lead Selection CH1/II, CH2/V1, CH3/V5		Press ENTER
Site Name:		Press ENTER
Printhead Resistance:		Open writer door and note resistance marking on label. Enter this value, then press Enter.
Key click: Medium		Press ENTER

Table 2

After you enter the key click, the LCD advances to the following:

```
CURRENT DATE AND TIME:  00/00/00  00:00
NEW DATE AND TIME:      00/00/00  00:00
```

Illustration 2

Set the current date by entering the numbers in a mm/dd/yy format. Enter the time using a 24 hour clock value. Then press ENTER to display the following screen:

Illustration 3

Check the date and time for the correct reading, and press ENTER again to start the clock. The LCD displays the main menu:

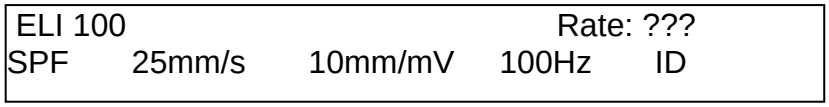


Illustration 4

Noise Test:

Press the 'mm/mV' key to change the Gain to 20 mm/mV, and connect a shoring plug at the patient input connector. Press the "Auto" ECG key. The following screen appears:

Illustration 5

Press YES. The following screen appears:

Illustration 6

Enter letters 'Q' to 'M', (e.g. q, w, e, r,) under the Last name, then press ENTER. Only the letters 'Q to Z' will appear on the LCD. Listen for the beep after pressing a key.

You can enter 12 characters in the first name field. After doing so, enter a character from Q to P and press ENTER. The following screen appears:

Illustration 7

Enter digits '0' to '9' in the Patient identification field, making sure all the digits are displayed on the LCD. Hold the backspace key to erase all the numbers and then enter the serial number from the back of the unit. Press ENTER. All the alpha and numeric keys are now tested.

Continue to press ENTER for Age, Hr(in), Wt(lb), Sex, Race, Medication 1, Medication 2, and Location. The message "Analyzing ECG" appears, followed by a printout of Trace 1.

Check Trace 1 for noise on all leads. Total peak and peak noise amplitude should not be more than 1.5 mm. Compare this to Sample Trace 1.

Check for drift on the same noise trace, from the start of the trace to the end of the trace. The total drift from time zero to time 10 seconds shall not exceed 1 mm.

Disconnect the shorting plug and connect the Patient Cable and ECG Simulator. Also press the EX key to display the main menu.

ECG, Keyboard and Cable Test:

Press the 'mm/mV' key on the Main Menu, to display 20mm/mV.

Press the ECG key. Press NO to the 'New Patient?' question.

Acquiring ECG, analyzing ECG, saving ECG appears on the LCD followed by a printout of Trace 2. To insure that the printhead is aligned properly, check the left hand edge of the 3 calibration pulses for variation of greater than 1 mm from the lower left edge of the top pulse to the lower left edge of the bottom pulse. Check the height of the calibration pulse. At 20mm/mV, it should be equal to exactly 4 large boxes. Specifically, check the ID number to see that it corresponds to the numbers entered. Look at the last name and first name to see that all of the letters are entered and check the HR value to see that it corresponds to the value set on the simulator (60 BPM), then check the ECG waveforms for all 12 leads against the Sample Trace 2. Noise between each complex should not exceed 1.5 mm (1-1/2 small red boxes) from peak to peak amplitude. Check for correct date and time on the lower left corner and check for the Printing Sequence number and Software version (i.e., v10/88) on the lower right corner. Do not tear off printout. The LCD displays the following:

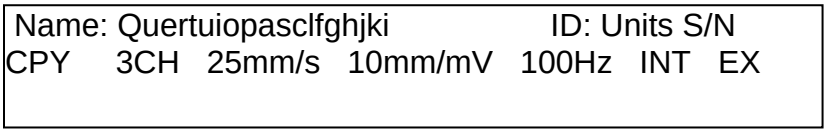


Illustration 8

Press EX. The main menu appears.

Rhythm Test:

Press the RHY key. The following screen appears:

Illustration 9

Press STAT. The rhythm strip starts printing leads II-V1-V5 and the following screen appears:

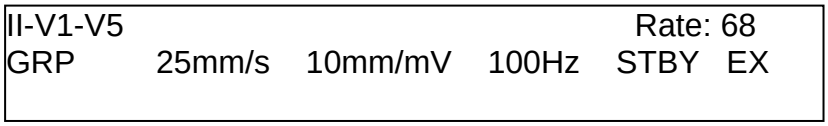


Illustration 10

Press GRP after 2 QRS complexes are printed to toggle through the lead groups: I-II-III, aVR-aVL-aVF, V1-V2-V3 and V4-V5-V6. Look for noise, watch for changing faded areas on the printout indicating a need for writer adjustment. Compare this to Sample Trace 3.

Press the 'mm/s key and print 2 complexes at 50 mm/s. Press the key again and print 3 complexes at 5 mm/s.

Press the 'Hz' key and print 3 complexes at 40Hz.

Press the 'mm/mV' key and print 3 complexes at 20 mm/mV.

Press STOP.

Lead Fail Test:

With the patient cable connected to the ELI 100, remove one lead at a time from the simulator and check Lead Fail messages on the Main Menu as follows:

Lead Removed	**Message on LCD**
LL	RL/RA/LA/LL/V?
RL	RL/RA/LA/LL/V?
LA	RL/RA/LA/LL/V?
RA	RL/RA/LA/LL/V?
V1	V1
V2	V2
V3	V3
V4	V4
V5	V5
V6	V6

Table 3

Directory Test:

Press SPF. The following screen appears:

Illustration 11

Press LIST DIR to receive a printout of the directory. (See Trace 4.)

Press DIR to display the next screen.

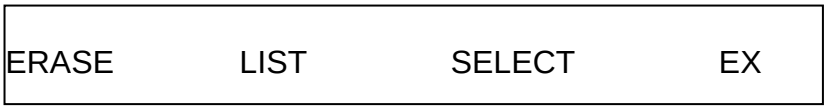


Illustration 12

The most recently acquired record appears on the LCD (identified by the last name field).

Transmit/Receive Test:

Connect the unit under test to a fully functional ELI 100 via the serial ports using the direct Transmit/Receive cable, and set both units to the same baud rate.

Power up the functional unit from the keyboard and press "SPF". The following screen appears:

Illustration 13

Press "RCV". The following screen appears:

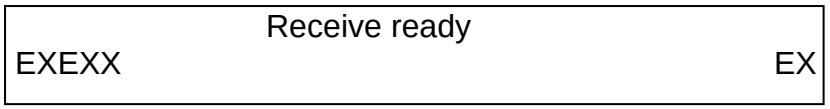


Illustration 14

The functional unit is now ready to receive ECGs.

In order to transmit with the unit under test, it is necessary to have acquired an ECG using the simulator. Acquire an ECG and enter the unit's serial no. as the patient ID Then, from the Special function screen, press DIR. After doing so, press SELECT, and the next menu appears. Press SELECT again. Finally, press XMT, and the following screen appears:

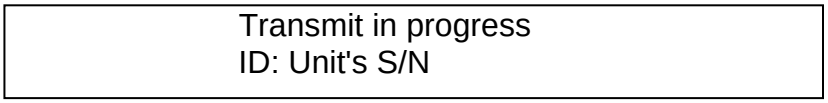


Illustration 15

On the functional (Receiving) unit, press EX. Then press DIR. The just received record is automatically displayed. Compare the last name field and the ID number with the original record.

Direct Receive:

On the unit under test, select "SPF" from the Main Menu. Then, press the "RCV" key. The LCD should display "RECEIVE READY".

On the functional unit, press the "XMT" key from the directory after selecting the record. The previously received ECG will be transmitted back to the unit under test.

On the unit under test, select "SPF" from the Main Menu. Then, select "LIST DIR" from the next screen. A printout of the directory will show the originally transmitted and then re-received ECG with an "X" under the "XMT" column. Compare this to Sample Trace 4.

Now delete each record on the unit under test. This is done by selecting each record individually, then pressing the "DEL" key. (This key label will change to RCR when the key has been pressed.) Using the arrow keys, select each record and repeat the process until all records of the directory are deleted. Now press "LIST DIR" to obtain a printout of the directory. You will now see an "X" in the column labeled "DEL".

Modem Transmission:

A fully functional unit must be available with a modem card either at the same location or at an outside location to do this test. Connect the unit under test to a phone line.

Press "STOP", followed by "ALT" and "SPF" to access the "CONF/CLOCK" screen. Press "CONF" and "ENTER" until the BAUD RATE selection field appears. Press "38400" and the baud rate should switch to "9600". Press ENTER and set the phone number of the unit being transmitted to, by using the numeric keys.

Note: If a number is necessary to access a dial tone for an outside line, separate the numbers by the uppercase letter "W". (i.e. 9W3541600). Press ENTER until the "CONF/CLOCK" screen appears: then, press the "EXIT" key.

Press "SPF" from the Main Menu. Press "DIR". From the directory printout, select and ECG that has not been transmitted from the unit under test by pressing the appropriate arrow key on the display.

Connect the functional (Receiving) unit to a phone line and power up from the keyboard.

Press "STOP", followed by "ALT" and "SPF" to access the "CONF/CLOCK" screen. Press "CONF" and ENTER until the BAUD RATE selection field appears. Press "38400" and the baud rate should switch to "1200". Press ENTER and set the phone number of the unit under test. Press the "EXIT" key twice to return to the Main Menu.

Press the "SPF" key then press the "RCV" key. The LCD should display "RECEIVE READY".

On the unit under test, press the "XMT" key to transmit the selected ECG. Listen for the dial tone and the phone number being dialed. Observe the receiving unit. The message" "RECEIVING ECG" should appear on the LCD.

After the message: "RECEIVE READY" appears on the LCD of the receiving unit, press the "STOP" key of the unit under test, followed by "SPF", then "RCV" to allow the unit under test to receive an ECG.

Modem Receive:

On the functional unit, press the "STOP" key, followed by "SPF", then "DIR". Next, Press SELECT twice. Press the "XMT" key to send the ECG to the unit under test. Listen for a dial tone, followed by the phone number being dialed. On the unit under test, observe the LCD displaying the message: "RECEIVING ECG".
When the message: "RECEIVE READY" appears on the unit under test, press the "STOP" key on the functional unit and turn it off.

Press the "STOP" key on the unit under test. Press the "SPF" key, followed by "LIST DIR". All ECGs that have been transmitted should have an "X" under the "XMT" column.

Re-program the original phone number and baud rate as described in step 1.10.11. Remove power from both units.

Writer Self Test:

Power up the unit from the keyboard and install a roll of thermal paper into the writer.

Press "ALT" and "0" simultaneously to access the "CONF" and "CLOCK" menu. Press "ALT" and "T" simultaneously to initiate the self test. The LCD will display.

Illustration 17

The number displayed in the lower right corner of the LCD corresponds to the end address of memory. If a faulty memory location is detected, the address number of the location will be displayed in the center of the lower LCD line.

The contrast test consists of a sequence of six squares having closely spaced vertical lines. In each square the lines should be placed so that distinct lines begin to be visible in the third square when a unit is printing at properly adjusted contrast.

The cal pulse at the bottom of the trace and the ramp should be of even darkness and there should be no gaps or light spots in the printing. Measure the line at the end of the printout in order to ascertain if the paper drive motor speed is within tolerance. It should be 100 mm +/- 2 mm. Compare this to Sample Trace 5.

Also compare the characters printed at the top of the printout, consisting of the message AMPLIFIER OK, date and time, and a list of alphanumeric characters (including special characters).

This concludes the writer self test. If the unit is left in the test mode, it will automatically generate a SELF TEST printout once an hour. During this time, no keys pressed except for the ON/OFF key will be acknowledged. The unit will beep when a key is pressed, but will not respond in the normal way. In order to leave the test mode, the power must be turned off, or the STOP key pressed. ***This concludes the Performance Tests.***

Description of Leakage Tests

NOTE: Measures the Safety Ground at any exposed metal part of the ELI 100 except RS232 connector pins.

Leakage Tests:

Must be performed whenever the PCB assembly, Ac connector assembly, AC switch assembly, or the Writer are removed and replaced. Tests should be performed using an AC variac adjusted to 10% over the normal line voltage.

Earth Leakage Current Measurement

This test measures the leakage from the AC input circuitry to the earth ground connection of the unit. Test both normal and single fault conditions, as well as reversing the line polarity. Worst case readings can not exceed 100μA.

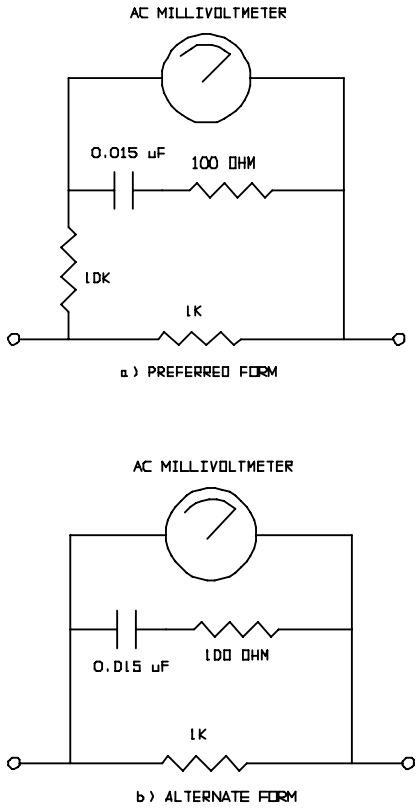


Fig 8-a Measuring Device Form

Chassis Leakage Current Measurement

Same as Earth Leakage Current, but the leakage current to various points on the chassis, such as the Writer lid and the safety ground are measured instead.

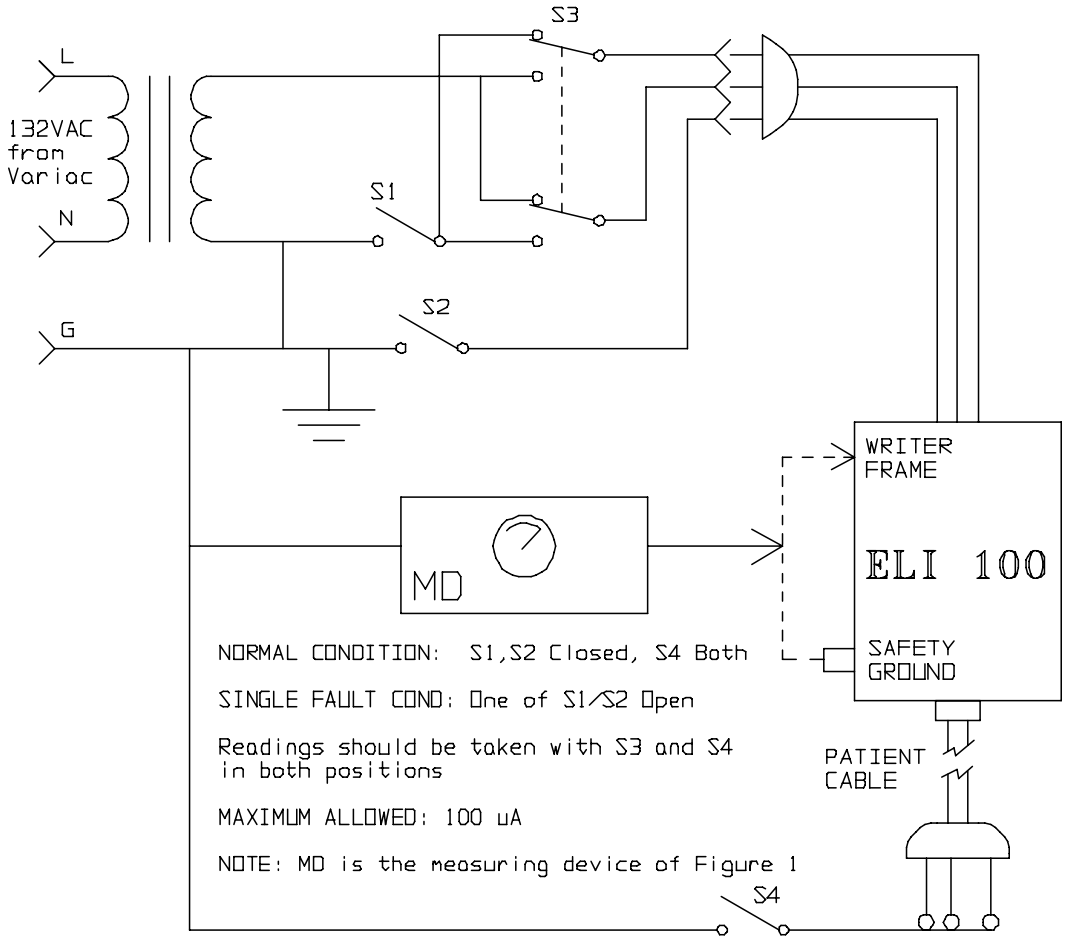


Fig 8-b Chassis Leakage

Patient Leakage Current Measurement:

This test measures the leakage current from the AC input circuitry to the isolated patient – connected circuitry. The normal condition with line polarity reversed should be tested. Worst case readings can not exceed 10μA.

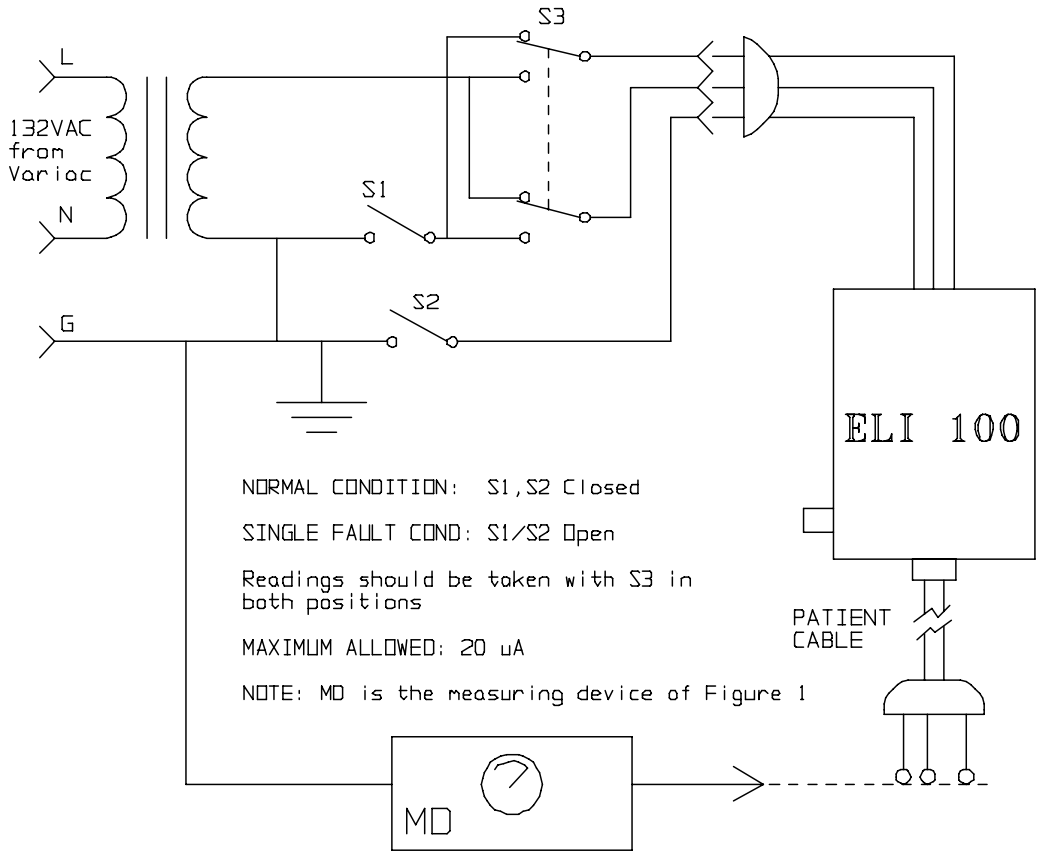


Fig 8-c Patient Sink Current

Line Voltage Applied to Patient Connection Leakage Current Measurement:

In this test, a potential at 10% over the line voltage is applied to the patient connection and the leakage current with respect to earth ground is measured. The normal condition with line polarity reversed should be tested. Worst case readings can not exceed 20μA.

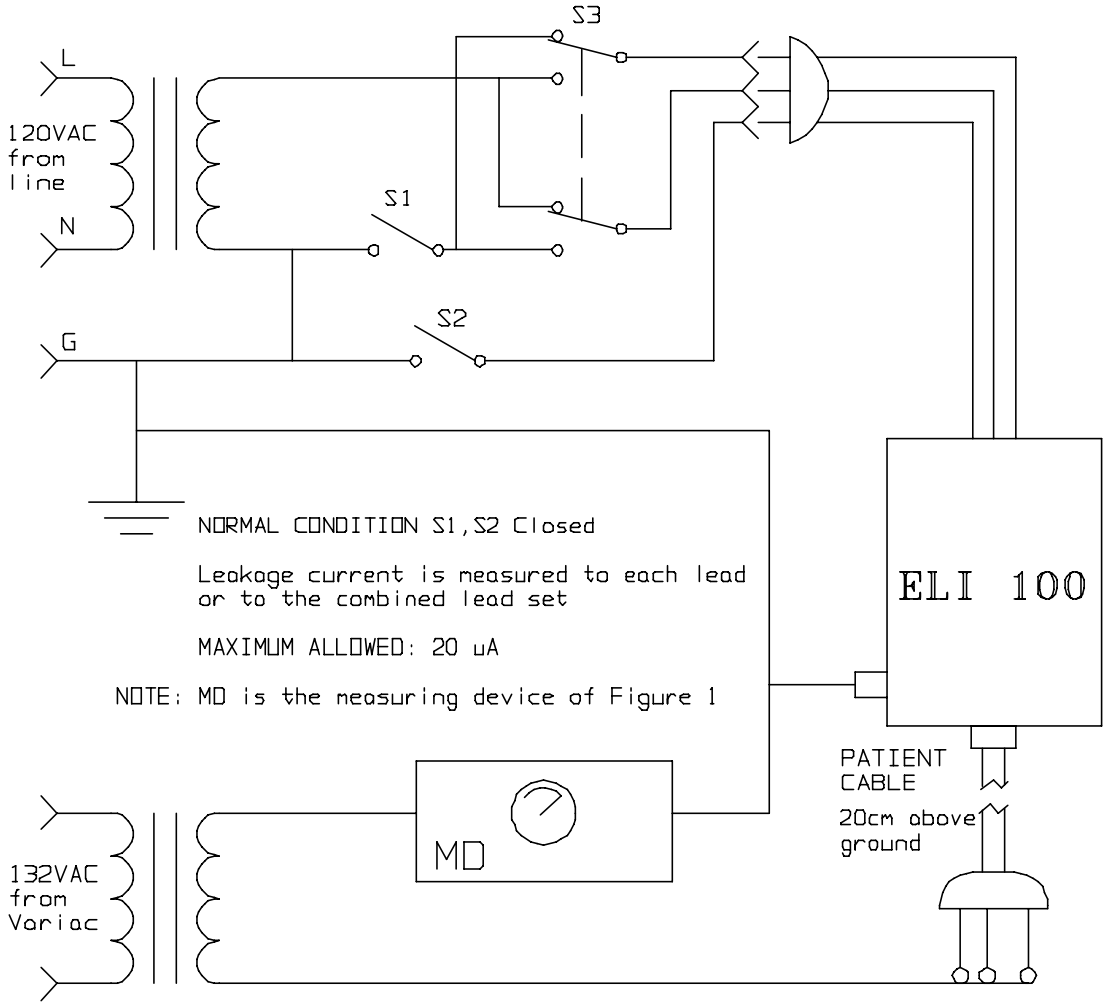


Fig 8-d Patient Source Current

Ground Integrity Test:

Whenever the Writer, PCB assembly, or AC connector assembly are removed and replaced, it is necessary to check continuity from the affected chassis ground points (Writer Lid, safety ground) to the unit's earth ground connection. The resistance can not exceed 0.1Ω

Appendix A Sample Traces

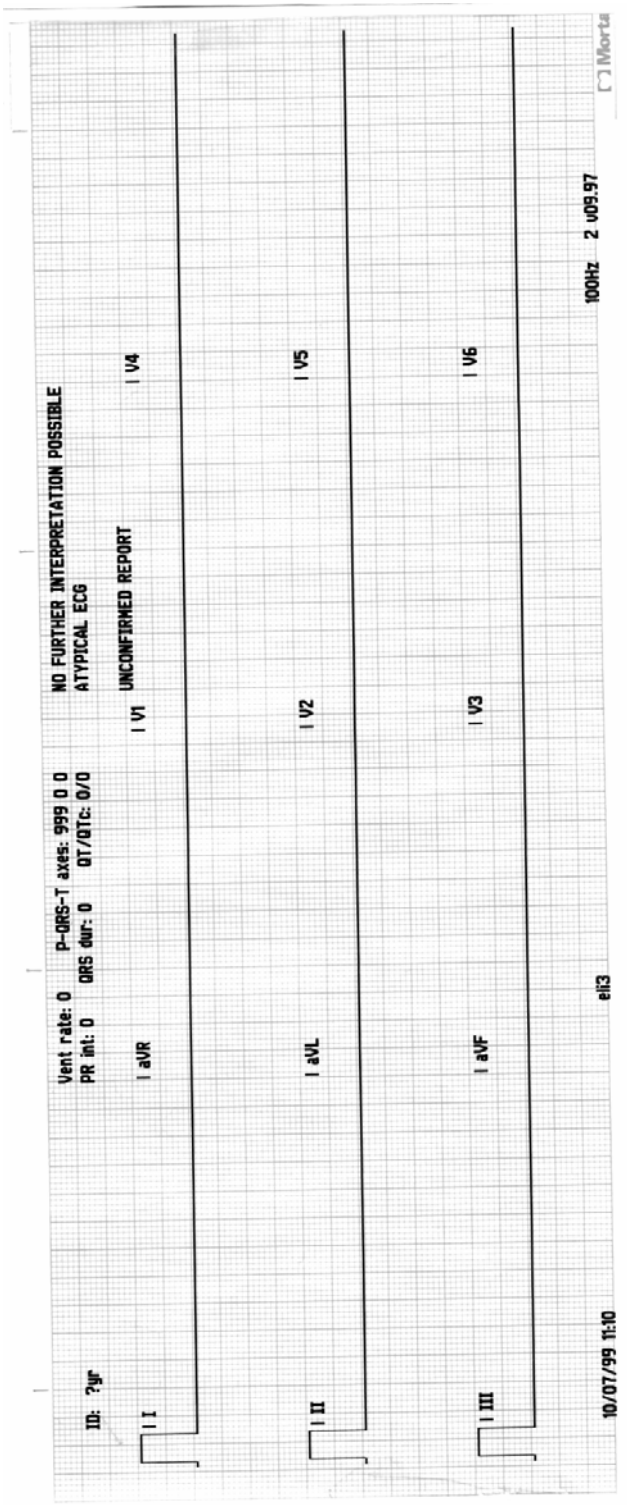


Fig A-a Trace 1 - Noise / Drift Test

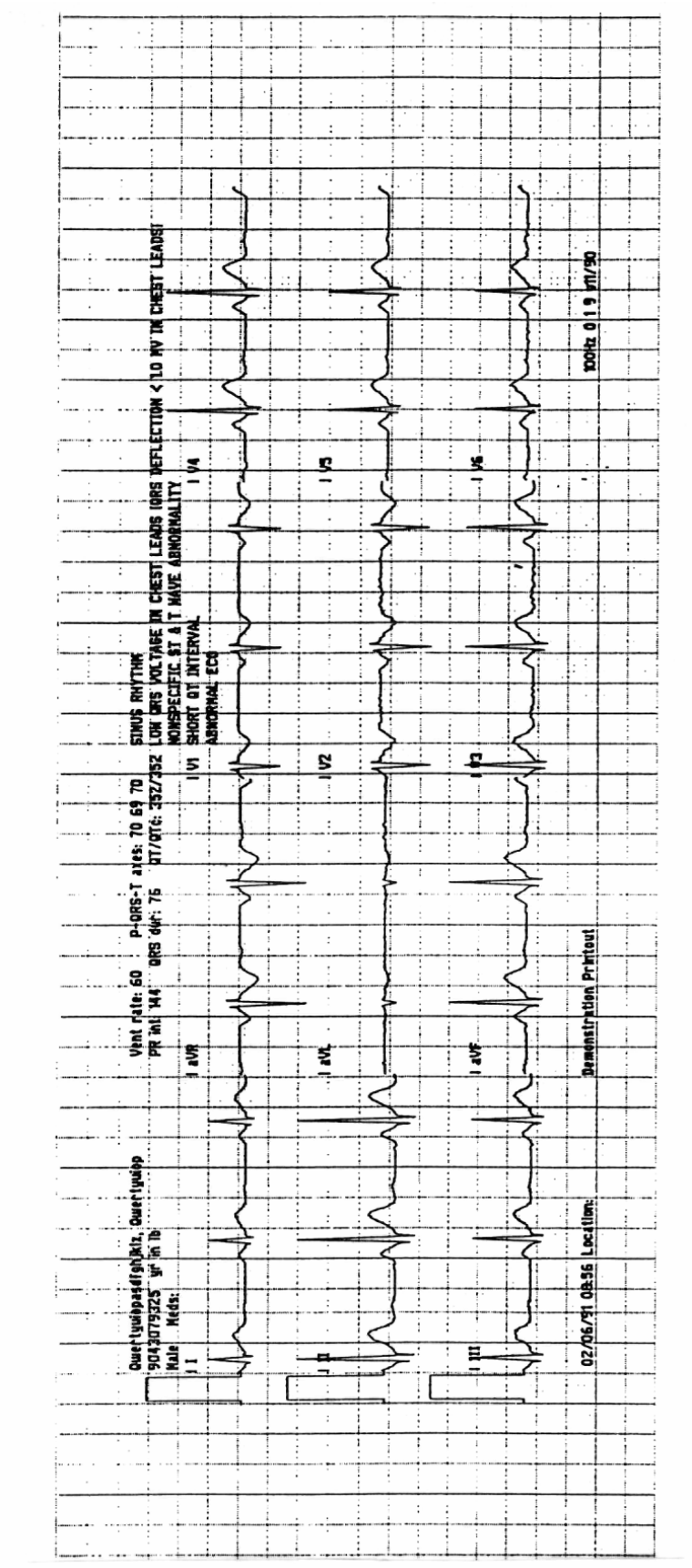


Fig A-b Trace 2 - 12-Lead Auto ECG

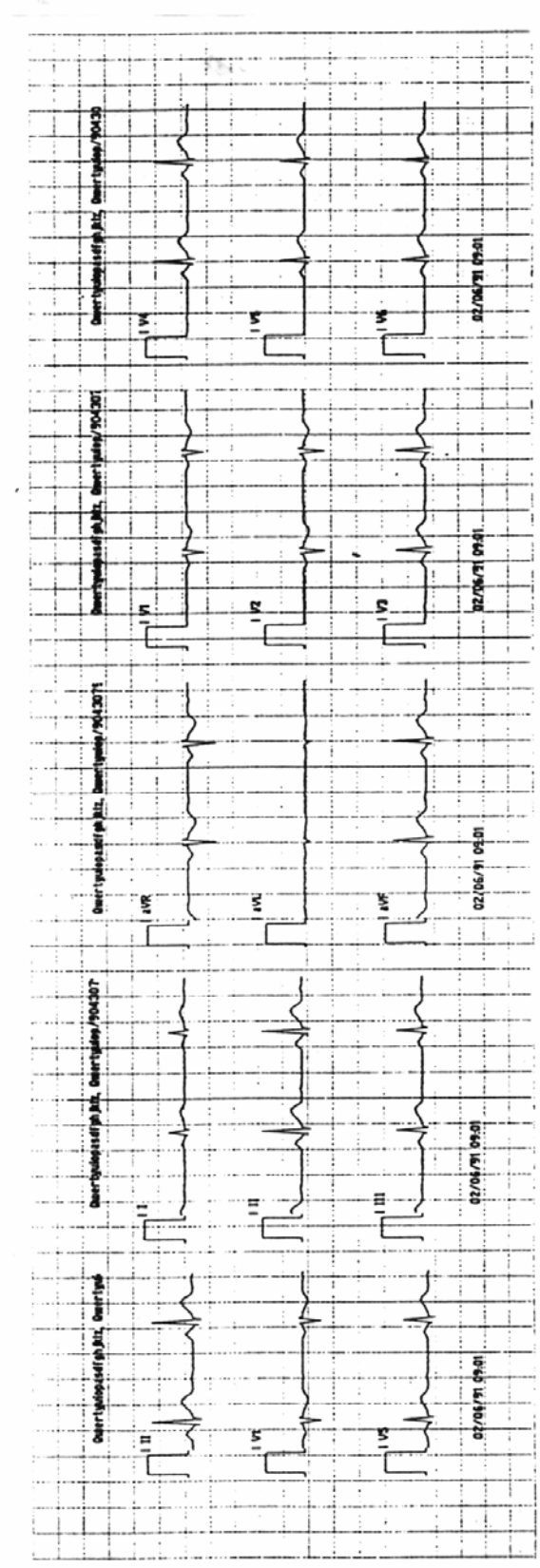


Fig A-c Trace 3 - Rhythm Strips

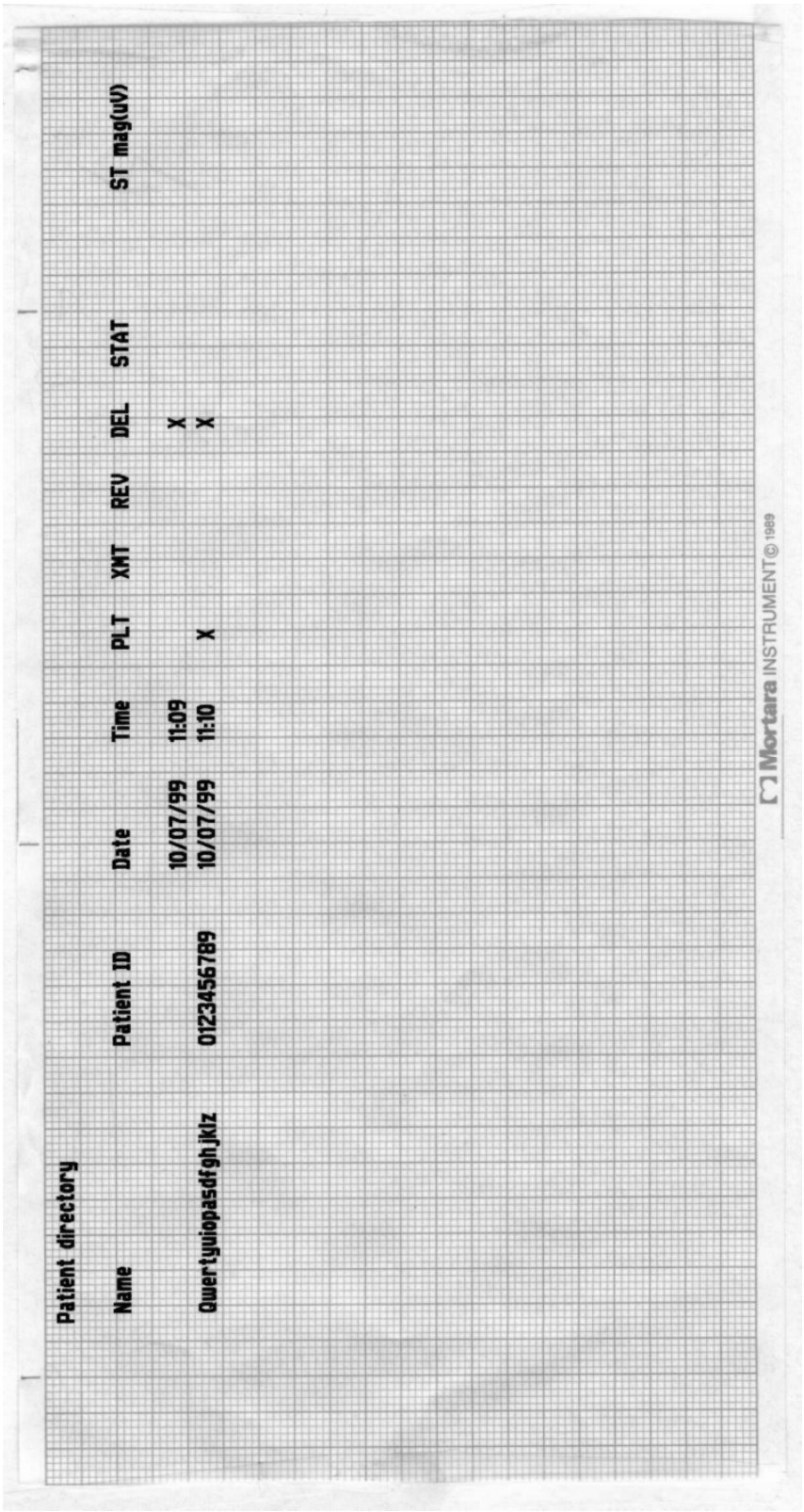


Fig A-d Trace 4 - Directory

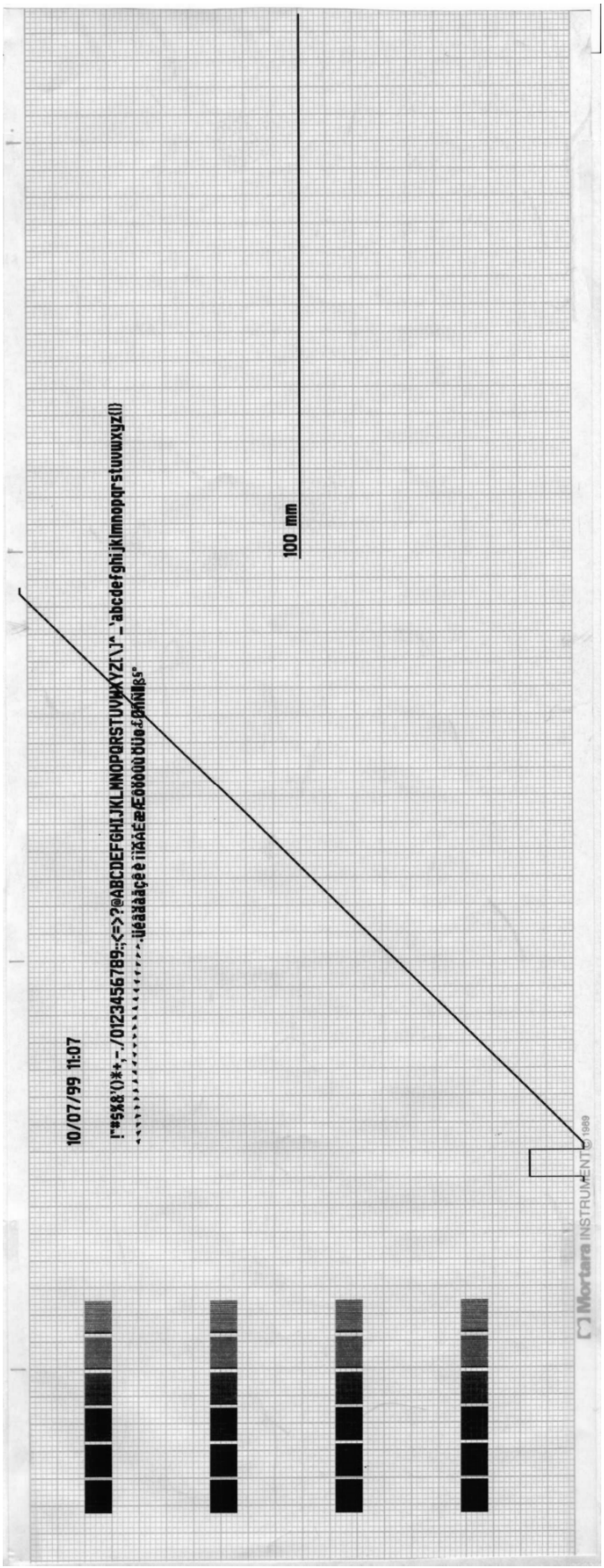


Fig A-e Trace 5 - Writer Self Test

Appendix B Modem Module(s) (MMM)

Introduction

This section provides illustrations and the schematics for the ELI 100 printed circuit boards. The parts lists have not been provided, as the boards are to be ordered for replacement as a whole, not they're individual components

Anti-Static equipment should always be worn when working with static sensitive devices and in a static sensitive area.

Modem Module (MMM) 2 MRAM PCB Ref: 26025-003-50

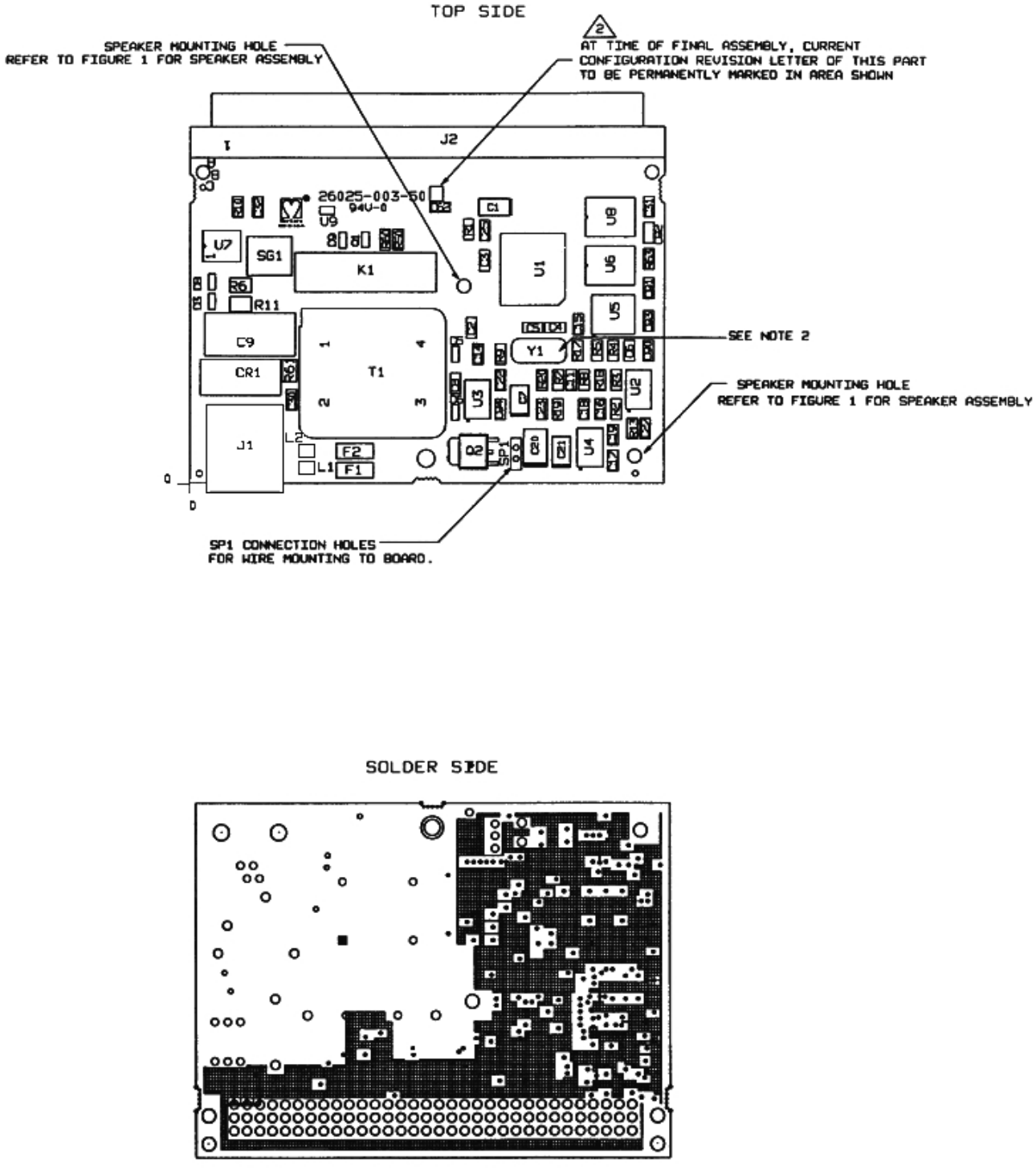


Fig B-a Modem Module (MMM) 2 MRAM Printed Circuit Board Assembly Ref: 26025-003-50

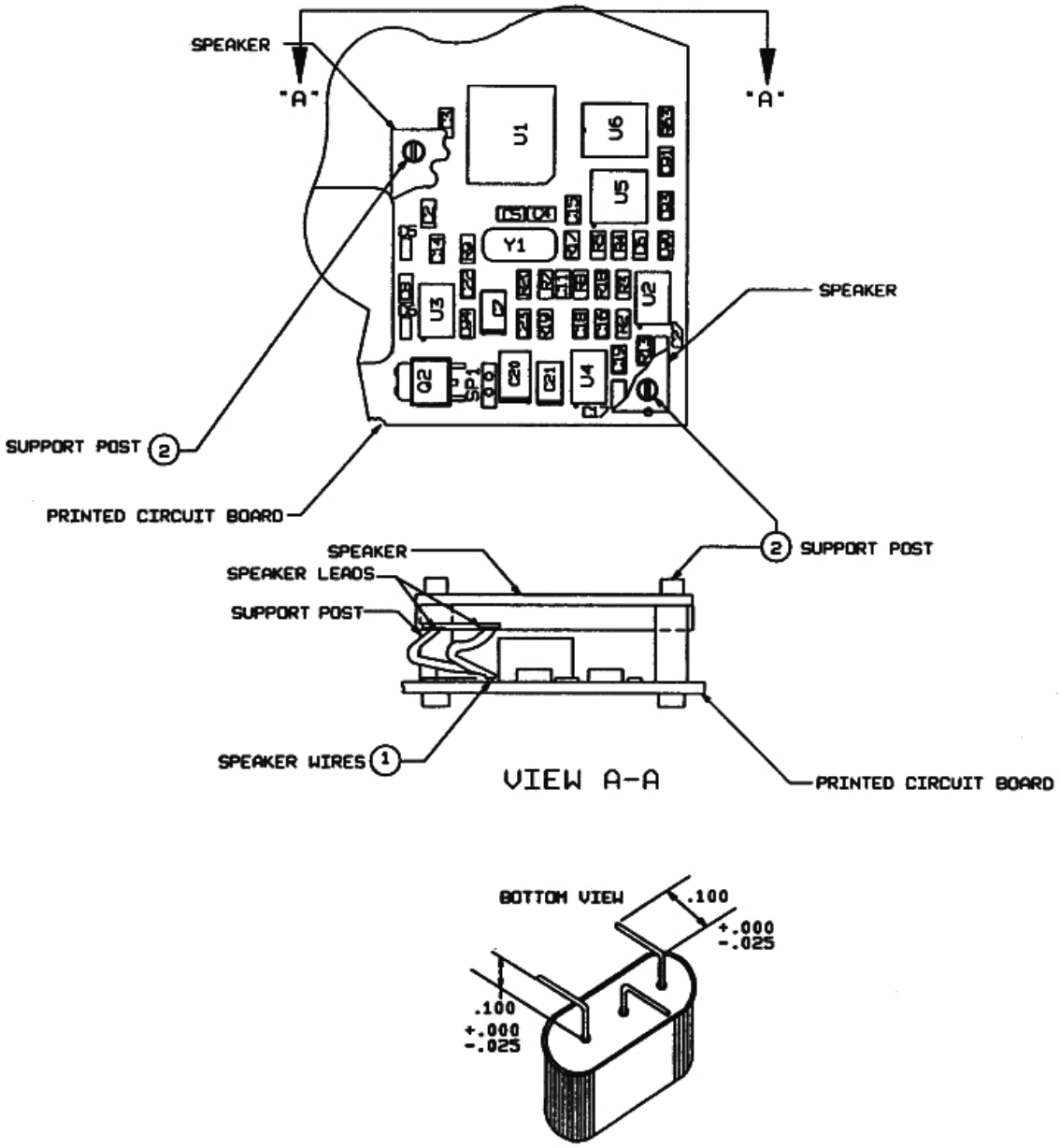


Fig B-b Views and Details for Mounting Crystal

Assembly Notes:

Speaker Attachment:

Place support posts in holes (See View A-A above).

Place speaker with metallic leads closest to the transformer and with label facing printed circuit board on top of support posts.

To both of the speaker leads: solder one end of the wire, Item 1, to the speaker lead and the other end to the printed circuit board hole marked SP1.

Leads for crystal, Y1, must be formed (See View above) before installation.

REF DES	X	Y
C1	2.4	2.1
C2	2.2	1.2
C3	2.3	1.7
C4	2.9	1.2
C5	2.7	1.2
C6	3.4	1.0
C7	2.6	0.7
C8	2.1	0.8
C9	0.5	1.2
C11	3.0	0.8
C14	2.3	1.0
C15	3.0	1.2
C16	3.2	0.6
C17	3.3	0.2
C18	3.1	0.6
C19	3.3	0.4
C20	2.7	0.3
C21	2.9	0.3
C22	2.4	0.8
C23	2.8	0.6

REF DES	X	Y
C25	2.3	1.9
C27	3.6	0.4
C30	0.8	0.7
C31	3.6	2.1
C32	0.5	2.1
C62	2.0	2.1
C90	3.6	1.0
C91	3.6	1.5
C92	3.6	1.9
C93	3.6	1.3
C94	2.4	0.6
CR1	0.4	0.8
D3	0.2	1.4
D5	2.1	1.0
D6	2.1	0.6
D8	0.2	1.6
D9	1.2	1.9
F1	1.3	0.1
F2	1.3	0.3
J1	0.4	0.5

REF DES	X	Y
J2	0.3	2.5
K1	1.4	1.6
L1	0.9	0.1
L2	0.9	0.3
Q1	1.4	1.9
Q2	2.3	0.3
R1	2.2	2.0
R2	3.3	0.6
R3	3.3	0.8
R4	3.3	1.0
R5	3.2	1.0
R6	0.4	1.5
R7	2.9	0.8
R8	3.1	0.8
R9	2.4	1.0
R10	0.4	2.1
R11	0.4	1.4
R13	3.5	0.4
R17	3.0	1.0
R18	3.2	0.8

REF DES	X	Y
R19	2.9	0.6
R20	2.8	0.8
R50	1.6	1.9
R60	1.5	1.9
R61	0.8	0.9
R63	3.6	1.7
SG1	0.6	1.8
SP1	2.6	0.2
T1	1.2	1.1
U1	2.7	1.7
U2	3.5	0.7
U3	2.3	0.7
U4	3.1	0.3
U5	3.3	1.3
U6	3.3	1.7
U7	0.2	1.7
U8	3.3	2.0
U9	1.1	2.1
Y1	2.7	1.0

Fig B-c Modem Module (MMM) 2 MRAM Board 'X' & 'Y' Coordinates Ref: 26025-003-50

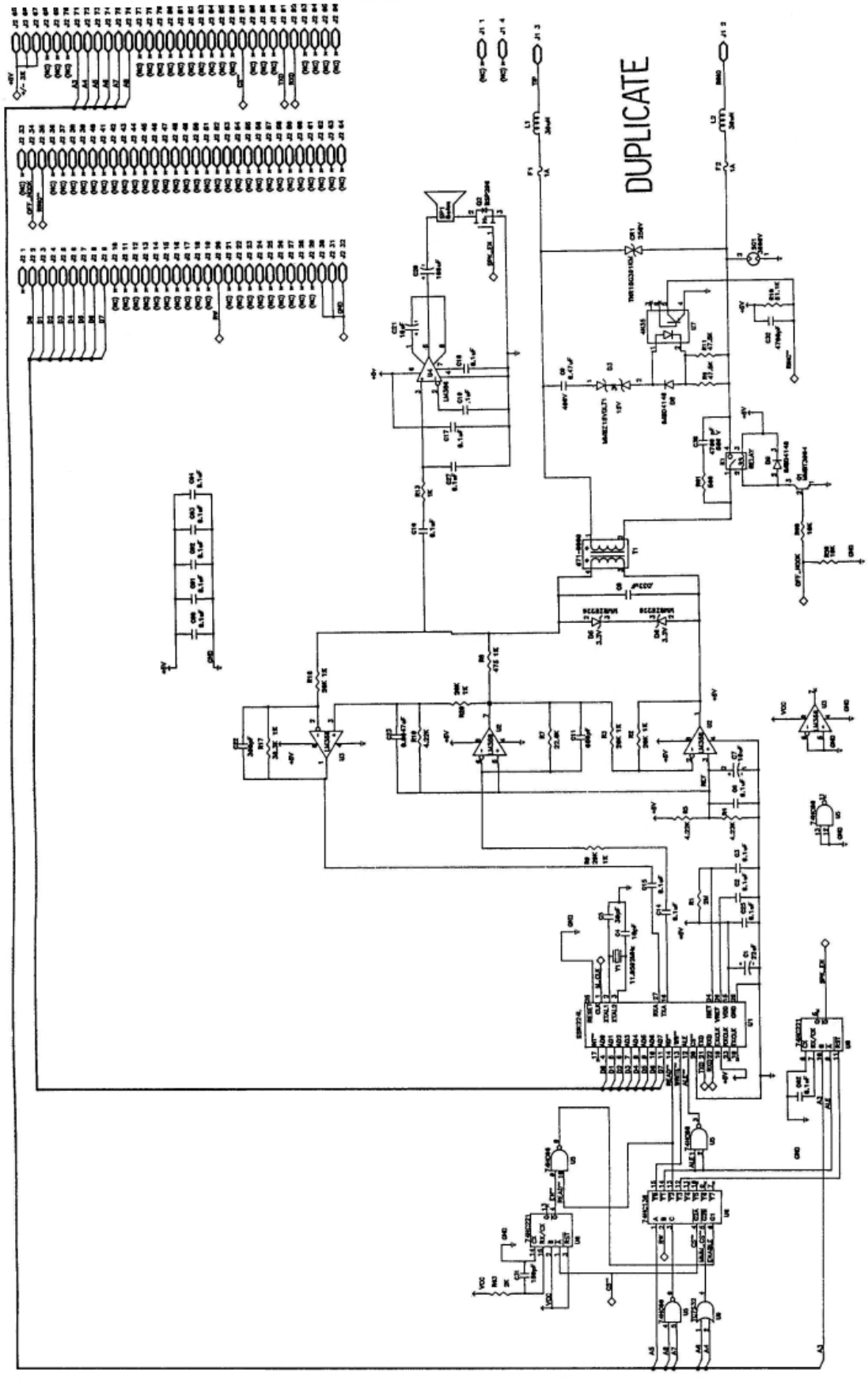
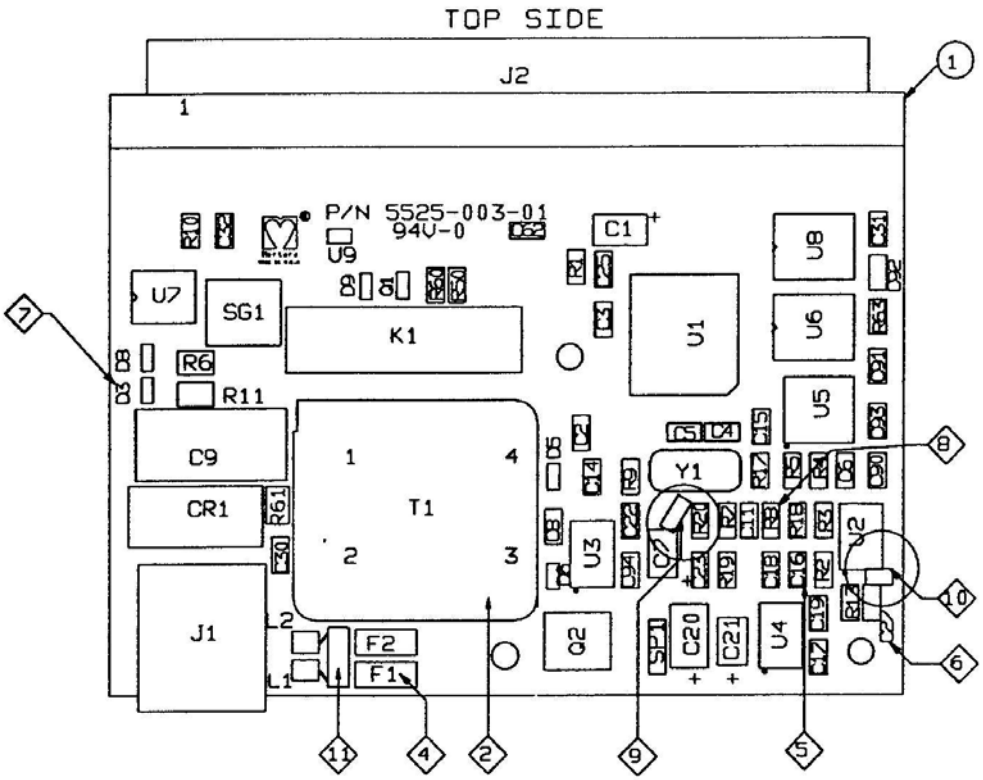


Fig B-d Modem Module (MMM) 2 MRAM Schematic Ref: 26025-003-50

Modem Module (MMM) 16 MRAM PCB Ref: 26025-003-51



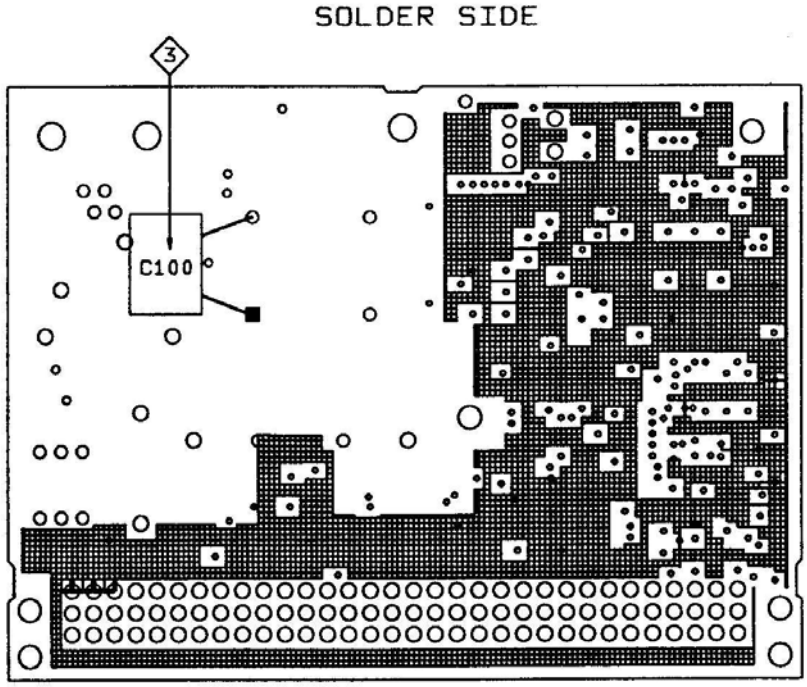


Fig B-e Modem Module (MMM) 16 MRAM Printed Circuit Board Assembly Ref: 26025-003-51

Modification Notes:

Remove C8, C16, C27, D3, F1, R8, SG1, and T1 from the assembled Modem Module Printed Circuit Board (MMM) Ref: 26025-003-50.

Replace T1 with 1410-808 Transformer Modem 4000VAC.

Solder C100 across primary leads 1 and 2 of T1 on bottom of board. See bottom view of board above.

Mount R100 in footprint vacated by F1. Mount R103 directly on top of R100 and solder.

Replace C16 on footprint vacated by C16.

Replace C27 on footprint vacated by C27.

Replace D3 and add D100 on footprint vacated by D3. See view below.

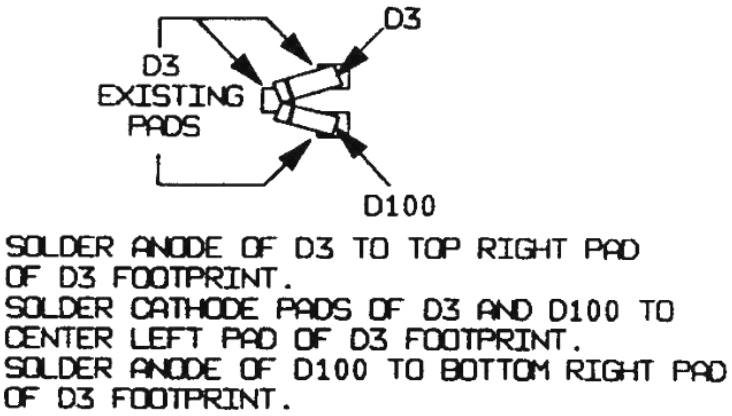


Fig B-f Installation of C27 and D100.

Solder R8 and C101 on the footprint vacated by R8.

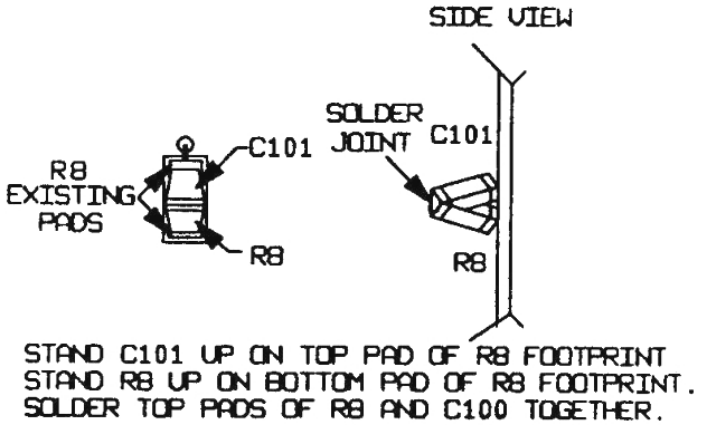


Fig B-g Installation of R8 and C101.

Solder R102 from top pad of R20 to top pad of C7.

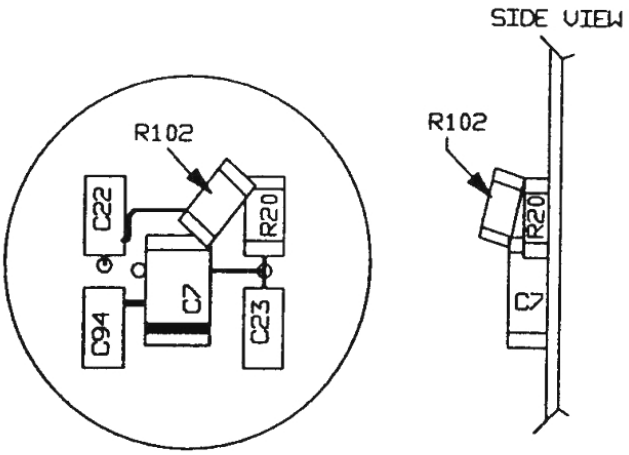


Fig B-h Installation of R102.

Mount R101 as follows:
Lay R101 on board surface with left pad butted and soldered to top pad of C27. Be careful not to short R101 to any other pad or trace.
Solder a jumper wire, approximately 1.00" long, from right pad of R101 to pin 1 of U2.
Secure R101 to board surface using "Tak-Pak" or equivalent.

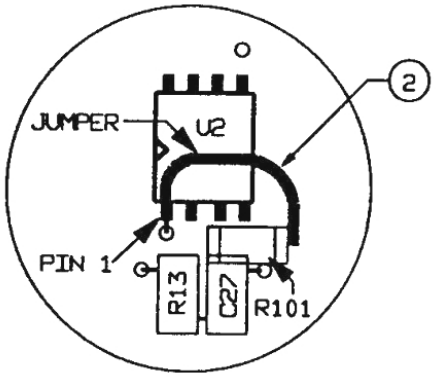


Fig B-i Installation of R101.

Add CR2 across right pads of L1 and L2.
After CR2 has been soldered, bend part over onto the tops of L1 and L2.

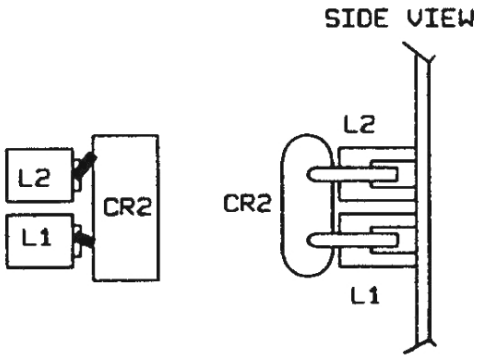


Fig B-j Installation of CR2.

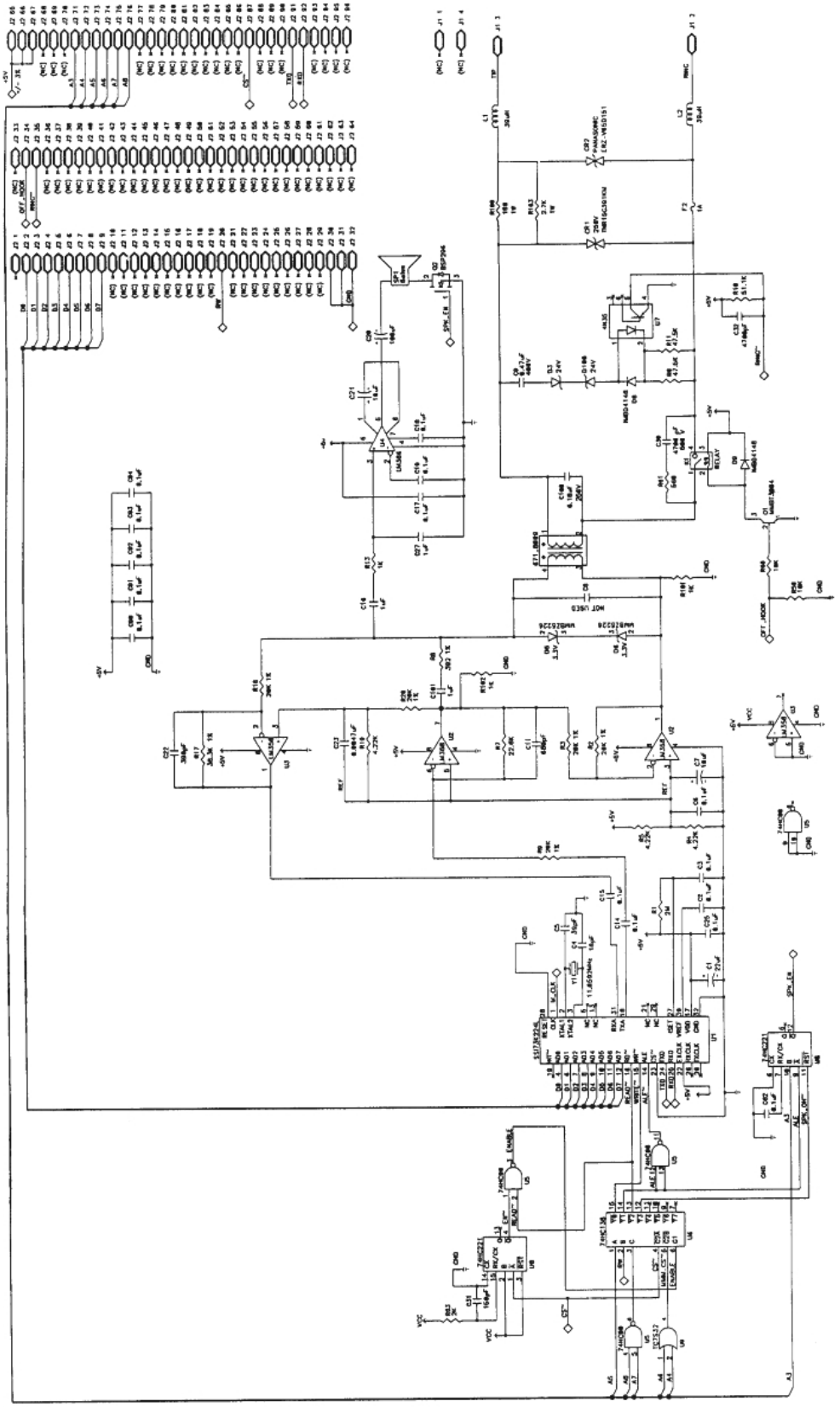


Fig B-k Modem Module (MMM) 16 MRAM Schematic Ref: 26025-003-51

Appendix C Mortara Receiver Module(s) (MRM)

Introduction

This section provides illustrations and the schematics for the ELI 100 Receiver Modules. The parts lists have not been provided, as the boards are to be ordered for replacement as a whole, not they're individual components

Anti-Static equipment should always be worn when working with static sensitive devices and in a static sensitive area.

I. Mortara Receiver Module (MRM-915) PCB Assembly Ref: 26125-001-50

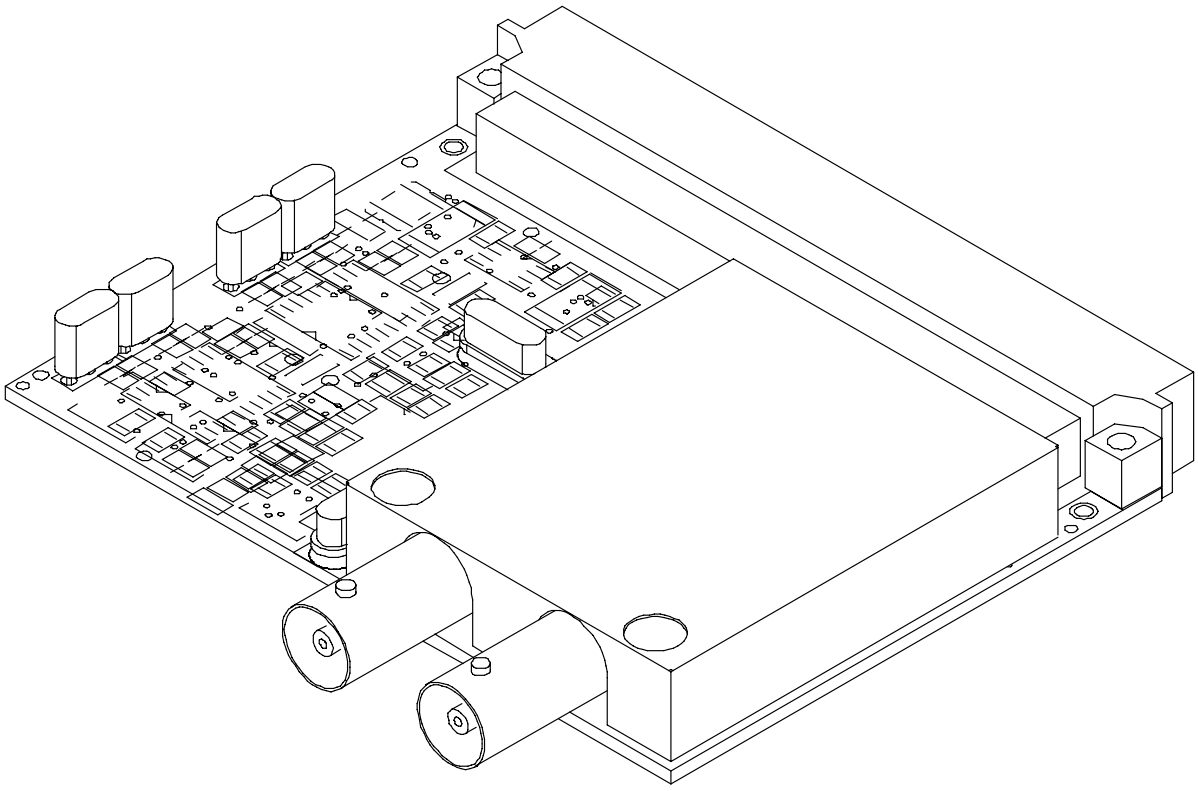


Fig C-a Mortara Receiver Module (MRM-915) Printed Circuit Board Assembly Complete Ref: 26125-001-50

Insert connectors, (Item 2) into printed circuit board holes and solder in place as shown.

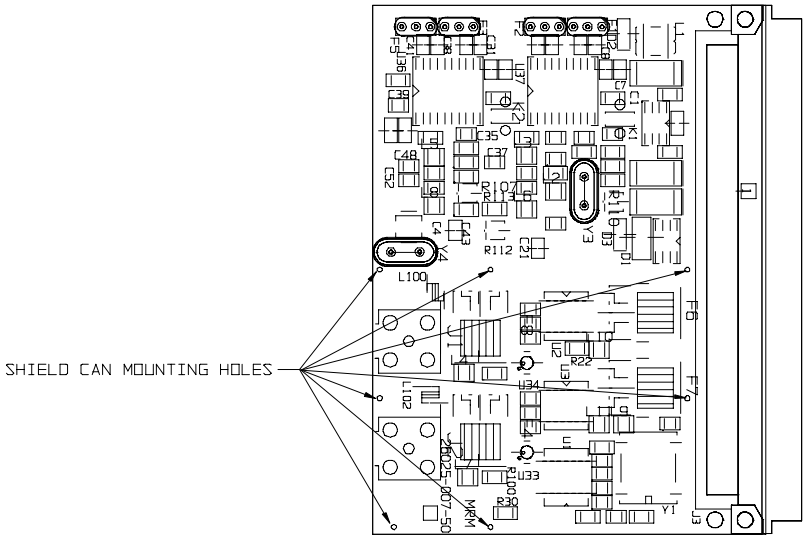


Fig C-b Shield Can Installation Holes

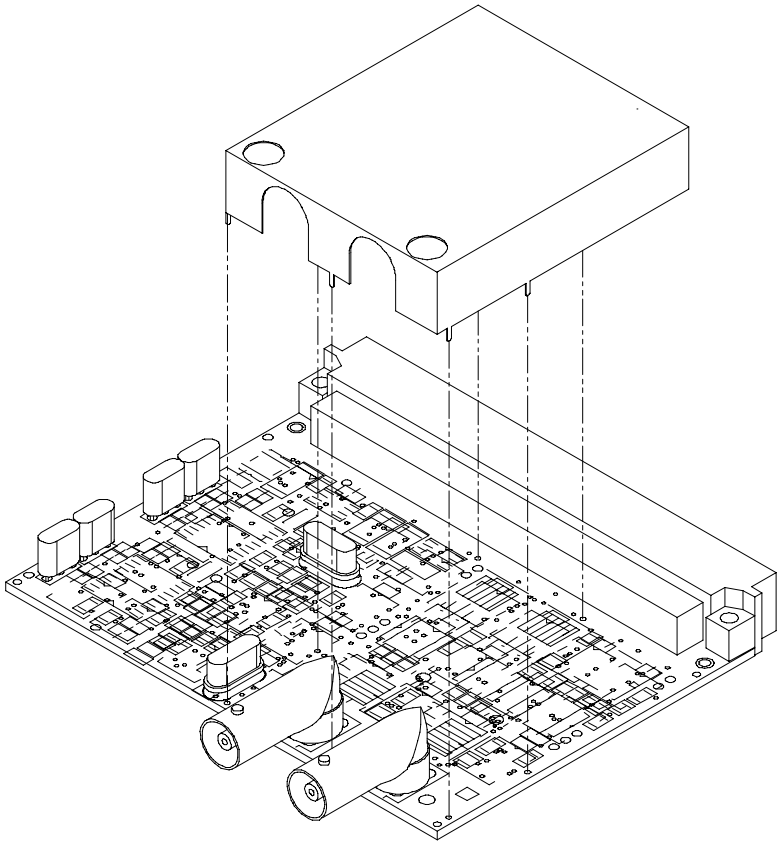


Fig C-c Installation of Shield Can

Notes:

From topside, insert shield can mounting tabs into corresponding holes and seat shield can against printed circuit board.
Keeping all edges of shield can in contact with printed circuit board, solder shield can to printed circuit board, from the backside, at all seven (7) mounting tab / hole locations.

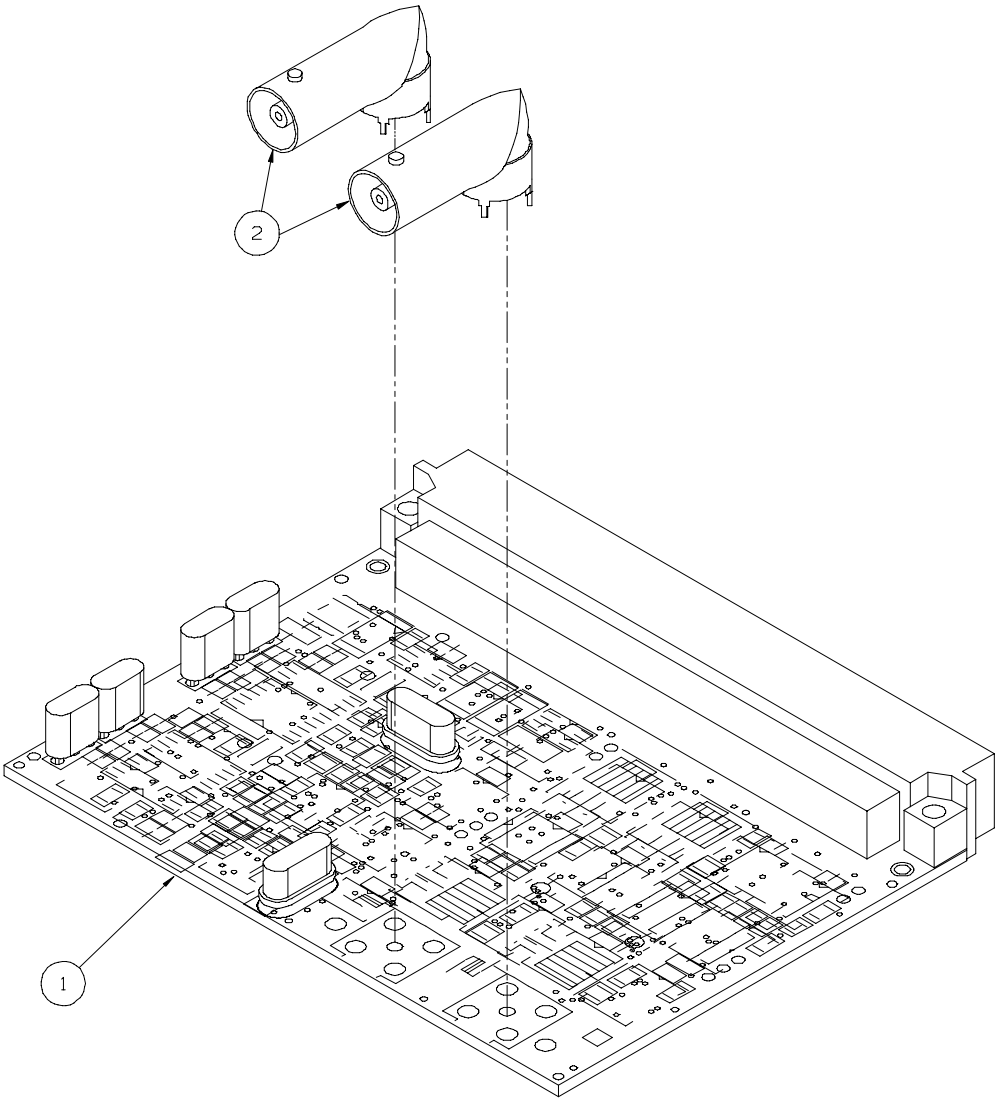


Fig C-d Installation of Connectors

Insert connectors, (Item 2) into printed circuit board holes and solder in place as shown.

II. Mortara Receiver Module (MRM-2500) PCB Ref: 26125-002-50

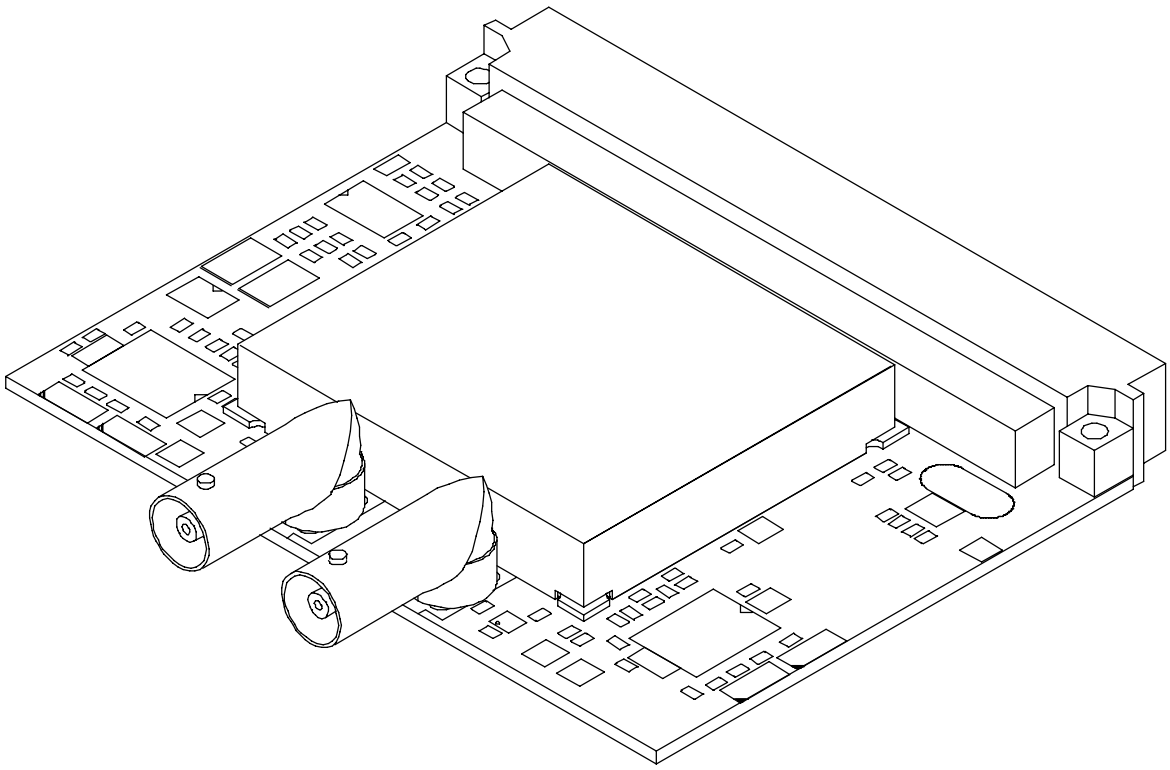


Fig C-e Mortara Receiver Module (MRM-2500) Printed Circuit Board Assembly Complete Ref: 26125-002-50

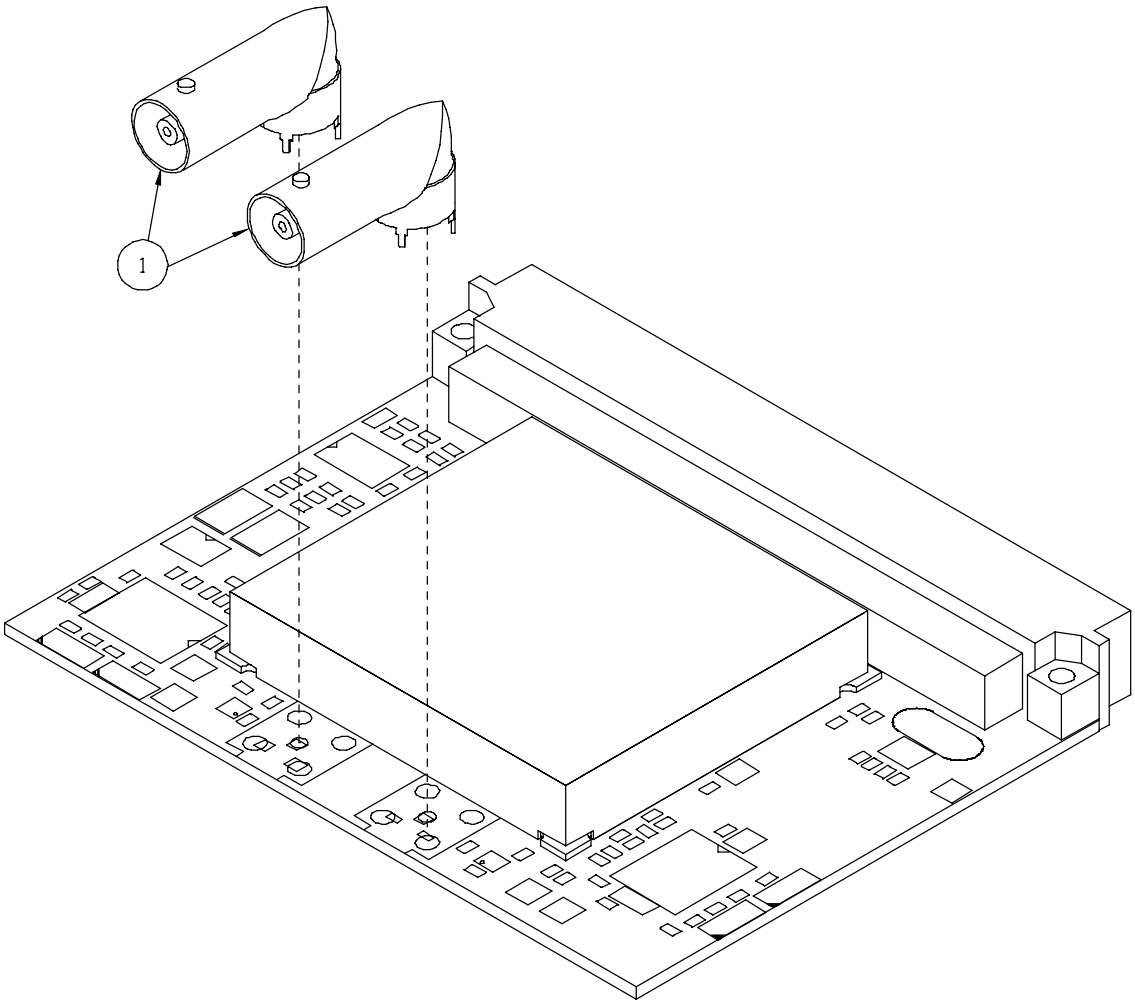


Fig C-f Installation of Connectors

Insert BNC Connectors (Item 1) as shown, connectors must be completely seated before soldering. Solder BNC pins to MRM II printed circuit board on opposite side of the board.

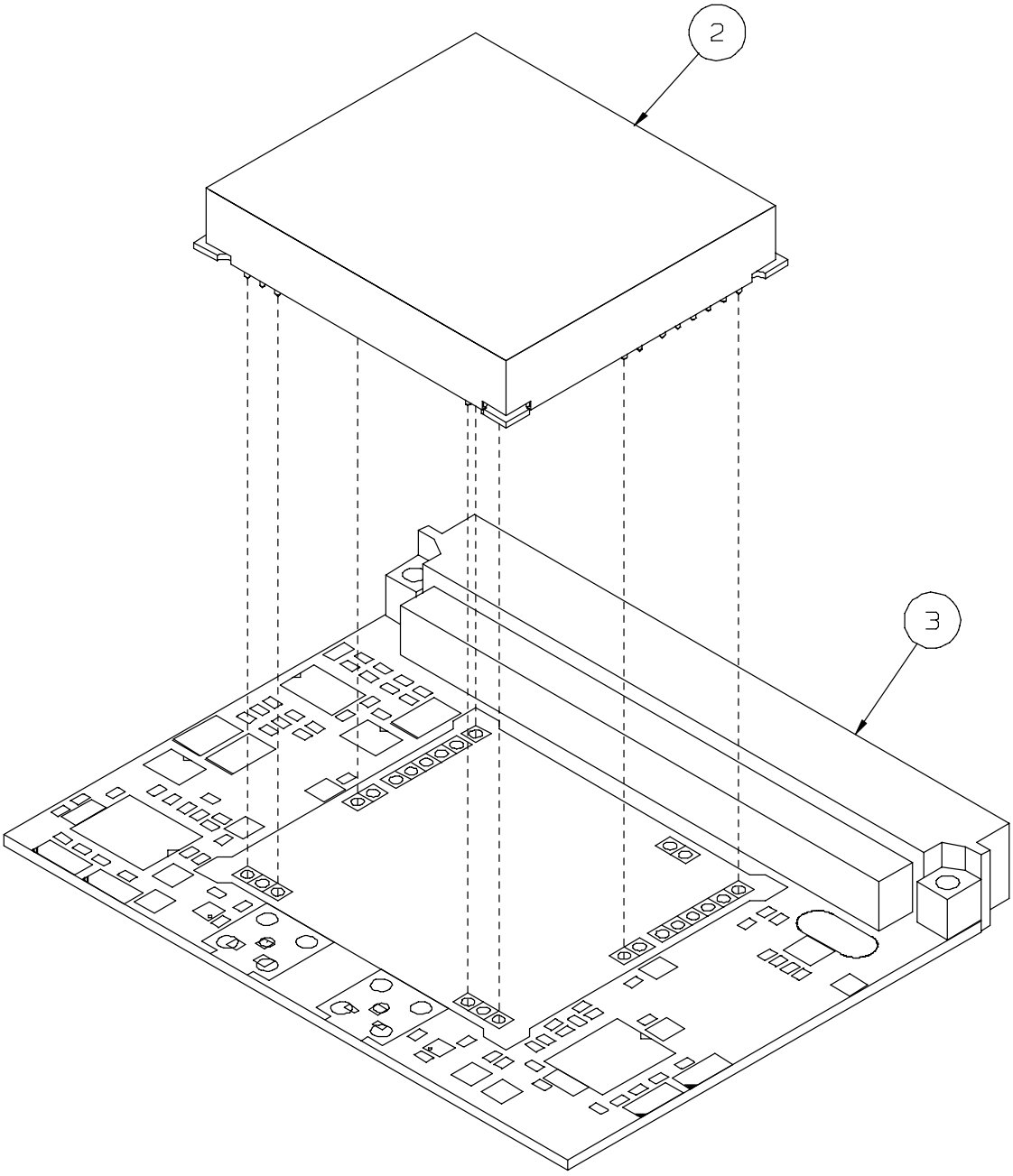


Fig C-g Installation of MDC-2500 Assembled Printed Circuit Board

Insert the pins of the MDC-2500 assembled printed circuit board (Item 2) (Ref: 26025-012-50) through the mounting holes on the MRM II assembled printed circuit board (Item 3) (Ref: 26025-013-50).

MDC-2500 board must be completely seated before soldering. Solder pins on the opposite side of the MRM II printed circuit board.

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Mortara INSTRUMENT
Milwaukee Bologna Essen Utrecht
7865 N. 86th STREET, MILWAUKEE, WI 53224
Telephone: (414) 354-1600 Outside Wisconsin: 1-888-Mortara
Fax: (414) 354-4760 http: //www.mortara.com

CAUTION!

Thermal Grid Recording Paper Storage Notes

1. Exposure to sunlight will cause yellowing of the paper and fading of the grid.
2. Store in a cool, dry, dark place, preferably below 80° F and 65% relative humidity.
3. Envelopes and sheet separators made of polyvinyl chloride (PVC), and similar plasticizer-containing material, cause loss of sensitivity of undeveloped paper and fading of printed images. Polyethylene, polypropylene, and polyester are satisfactory as storage containers.
4. Adhesives containing solvents, such as alcohol, ester and ketone, cause developments of the colored coating and should be avoided.

Likewise, most clear self-adhesive tapes cause image fading.

ATTENZIONE!

Istuzioni Per La Conservazione Della Carta Termica Millimetrata Da Registrazione

1. Se esposta alla luce solare, la carta termica ingiallisce e la griglia millimetrata scolorisce.
2. Conservare al buio in luogo fresco e asciutto. La temperatura deve essere preferibilmente inferiore a 26° C e l'umidità relativa del 65%.
3. Buste e fogli di separazione composti di cloruro di polivinile (PVC) e simili materiali contenenti plastificante causano scolorimento delle immagini e perdita di sensibilità della carta non avvolta in buste protettive. Si possono invece impiegare polietilene, polipropilene e poliestere come materiali per contenitori protettivi.
4. Evitare l'uso di adesivi contenenti solventi come alcool, estere e chetone che favoriscono lo sviluppo della pellicola termica con conseguente inscurimento della carta. Allo stesso modo, la maggior parte degli adesivi trasparenti causano lo scolorimento delle immagini.

VORSICHT!

Anmerkungen Zur Aufbewahrung Von Warmegitter-Aufzeichnungspapier

1. Aussezung an Sonnenlicht bewirkt Vergilben des Papiers und Verblassen des Rasters.
2. Aufbewahrungsort soll kuehl, trocken und dunkel sein, vorzugsweise mit einer Temperatur von unter 26.5 Celsius und 65% relativer Feuchtigkeit.
3. Umschlaege und Blattscheider, die aus Polyvinylchlori (PVC) und aehnlichen Plastifikatoren enthaltenden Materialien hergestellt sind, resultieren in Empfindlichkeitsverlusten des nicht entwickelten Papieres und Verblassen der gedruckten Bilder. Polyaethylen, Polypropylen und Polyester sind ausreichendals Aufbewahrungsbehaelter.
4. Klebestoffe, die Loesungsmittel enthalten, wie zum Beispiel Alkohol, Ester und Keton, verursachen die Entwicklung der Farbschicht und sollten vermieden werden.

Auch bewurken die meisten transparenten, selbsthaftenden Klebstreifen ein Verblassen der Bilder.

ATTENTION!

Instructions Sur Le Stockage Du Papier Quadrille D'engegistrement Thermique

1. Si le papier reste exposé àla lumière du jour, il jaunira et le quadrillage se decolorera.
2. Conserver dans un endroi frais, sec et sombre ayant de préférence une température de moins de 26.5° C. et une humidité relative de moins de 65%.
3. Les enveloppes ou séparations faites en chlorure de polyvinyle ou autre substance contenant un plastifiant semblable pourraient causer une perte de sensibilisation du papier non developpé et la décolorationdes papiers déjà imprimés. Les enveloppes en polyethylène polypropylène et polyester peuvent être employées.
4. Eviter d'employer tout adhésif à base de dissolvants tels que de l'alcool, ed l'ester et de l'acétone car il pourrait causer le développement de la couche colorée du papier.

Pour la même raison, la plupart des papiers collants transparents cousent la décoloration des images.

CUIDADO!

Papel Registrador De Malla Thermal Instrucciones De Almacentamiento

1. La exposición a la luz del sol producirá un color amarillento en el papel y descoloramiento de la rejilla.
2. Manténgase en un lugar fresco seco y oscuro, de preferencia a una temperatura de 26.5 C y a una Humedad Relative de un 65%.
3. Sobres y separadores de páginas fabricados de cloruro de polivinil (CPV) y de materiales que contienen plásticos, producen pérdida de sensibilidad del papel no revelado e impresión de imágines descoloridas. El polietileno, polipropileno y el poliéster son recipientes apropiados para almacenamiento.
4. Adhesivos que contienen solventes tales como alcohol, éster y acetona producen el revelado de la capa de color y no deben ser empleados.

La mayoría de las cintas adhesivas transparentes producen tambien imágines descoloridas.

REF.: 9504-001C1